MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXVI. JULY, 1898. No. 7

INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 1898, is based on about 2,940 reports from stations occupied by regular and voluntary observers, classified as follows: 147 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,583 from voluntary observers; 96 received through the Southern Pacific Railway Company; 29 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological and Magnetic Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. F. H. BIGELOW, in charge of Forecast Division.

The weather conditions in the month of July were generally quiet, with high temperature, frequent thunderstorms, and the usual stagnant circulation prevailing in the summer.

WIND SIGNALS.

No hurricanes developed on the south Atlantic or Gulf coasts. On the 11th, 12th, and 13th the conditions were threatening in the east Gulf States, and information telegrams were sent to those districts, but no storm signal orders were issued. During this period an area of increasing high pressure passed over the Lake region and New England, and on the evening of the 12th was central over the Gulf of St. Lawrence. The winds were moderately high during the evening. In the morning Atlantic City showed a pressure of 29.98 inches with the surrounding stations at 30.10 to 30.20 inches, and high winds on the New Jersey coast. Warnings were issued for the north Atlantic and New England coasts. The storm was of small dimensions, and filled up very generally, so that the 10 a. m. observation gave 30.10 at Atlantic City. This storm was attended by high winds near New York and on the southern New England coast, but it passed off to the east by night. The maximum velocities noted were Atlantic City, 42; Sandy Hook, 60; New York, 36; Block Island, 60; Boston, 32. Heavy rain fell in southern New England. These small storms are apt to form suddenly, near the north Atlantic coast, when a high is central over the Gulf of St. Lawrence and extends southwestward over the Atlantic States. In addition to the generally high northeast winds along the coast line, the pressure gradients sometimes give way and form a minor cyclonic whirl along the edge. These small storms develop rapidly, and it is very difficult to foresee their occurrence, as there is no onward propagation of the storm center. On the evening of July 19, a low area was located over Lake Superior, and a series of thunderstorms developed over Lake Michigan with high winds, 40 to 50 miles, at several stations. Warnings of thunderstorm squalls were issued for the lower Lakes. The storm, however, passed to the northward, with only one heavy wind, 52 miles being reported at Cleveland. No other storm warnings were issued by the Washington office during the month of July.—*F. H. Bigelow, Professor.*

THUNDERSTORM FORECASTS.

During July there occurred only the average number of thunderstorms appropriate to this month, and they were usually well covered in the forecasts. There are only two or three circumstances needing any special comment. Since the forecasts cover in general rather large districts, such as an entire State, indicating only that conditions are favorable for thunderstorms, and since the storms themselves are comparatively small in their dimensions, it often happens that such storms occur within a State but not at the Weather Bureau stations, which are, necessarily, on the average, about

200 miles apart, so that good forecasts are not always officially verified. Again, when these local storms are forecast for a given State, some of the towns may have a storm and some may not, so that certain persons may criticise adversely a perfectly correct forecast. Again, a discrepancy between the general public and the Bureau arises as to the system of verifying forecasts in one particular, viz, as regards temperatures in summer. The public notes the maximum temperatures of the afternoon; the Bureau verifies by the 8 p. m. map, several hours later than the time of maximum temperature. Now, if, after a hot day, a thunderstorm comes up and lowers the evening temperature decidedly, there is this difficulty in making the forecast. In the natural recovery of the ordinary summer temperature, the forecast should be warmer; but as the temperature before the storm was, for example, 95°, it is hardly fair to the public to make the forecast "warmer" for the 8 p. m. hour, since a higher maximum temperature would not probably occur. There is little else to be done than to sacrifice the record of the forecaster in favor of the public comfort.

A peculiar case of unexpected thunderstorms occurred on July 19, when they suddenly spread from the Lake region to the middle Atlantic coast, directly across the isobars of a high area. A fall of temperature occurred generally in New England and the North Atlantic States, where one would have expected a decided rise, judging from the positions of the high and low areas. These anomalies, in addition to the stagnant condition of the eastward movements, sometimes render the forecast of the summer months unusually difficult.—*F. H. Bigelow, Professor.*

COOL WAVE FORECAST.

An interesting case of the development of unusual weather conditions occurred during July 6–10. On the 6th an area of high pressure was central over New England, with every prospect that it would move to the northeastward. But on the 7th it began to settle southward along the Atlantic coast, and gradually became central on the south Atlantic coast, causing meanwhile thunderstorms in the east Gulf States. These were forecast on the 6th and 7th. Then, on the 8th, occurred a sudden fall in the pressure generally over the Atlantic States, with no apparent reason for it, and a low area developed over New England; at the same time a high area formed in the Northwest. On the morning of the 8th the forecast was made "pleasant temperature will prevail for two or three days in the District of Columbia, New England, and the Middle Atlantic States." A large high area passed over the northern districts, and from the 9th to the 13th cool and fair weather prevailed generally in these districts. These meteorologically rare conditions are by no means easy to understand, and they probably depend upon the atmospheric currents of the higher strata.—*F. H. Bigelow, Professor.*

HIGH TEMPERATURE FORECASTS.

On July 1, 2, 3, and 4 a warm wave with very high temperatures passed from the South Atlantic States northward over New England. During this period an area of high pressure was stationary off the south Atlantic coast, and a low area moved from the lower Missouri Valley and the Lakes to New England; these are conditions favorable for producing hot weather in the Atlantic States. On Chart VIII will be found the isotherms of the maximum temperatures for the above dates, showing the location of the hot wave. The forecasts of June 29 and 30 foretold the formation of the hot wave by saying, "high temperatures are indicated for the central valleys, the Gulf and Atlantic States, and New England," June 30; "continued high temperature" in same districts, July 1; "very high temperature," "very warm," July 2; "very warm," July 3, a. m.; "the temperature will be lower Monday in New England and the Middle Atlantic States," July 3, p. m.; "cooler weather," "cool in New England and the Atlantic States," July 4.

By following the progress of the heated area toward the northeast, and comparing with the forecasts, it will be seen that the course of development was satisfactorily anticipated.

From July 22 to 29 high temperatures prevailed on the Rocky Mountain slope, and the air being dry this period was unfavorable to the crops of those districts. A sketch of the series of maximum temperatures, frequently above 100°, is found on Charts Nos. IX, X, XI, and XII. The following forecasts were made: July 21, 8 p. m., "the temperature will continue warm throughout the Rocky Mountain districts;" July 22, "very high temperature will prevail on the Rocky Mountain slope;" July 23, "the temperature will continue high in the Southwest States;" and similarly for the following dates till the hot wave was broken. During this period the temperatures were high also in the Atlantic States but moderate in the Lake region.—*F. H. Bigelow, Professor.*

FORECASTS AT CHICAGO, ILL.

No storm signals were ordered for the upper Lakes during the month and no winds of a violent character occurred, except in the form of local squalls, which were forecast in daily advisory telegrams sent to Lake ports.

The most important weather feature of the month in the agricultural districts of the West and Northwest was the very warm and dry period, which continued until the 19th. The hot winds, which marked the closing days of the heated spell, had become a serious menace to crops, and the break in temperature during the day and night of the 19th was attended by local rains and thunderstorms generally in the principal corn and wheat growing States.

The Chicago morning forecast of the 18th called for—

> Local rains and thunderstorms in the northern tier of States from Michigan to Montana.

And the forecast of the 19th reads:

> The indications are that showers will occur this afternoon and to-night in the States of the Missouri and upper Mississippi valleys and the western Lake region, with a more moderate temperature. On the upper Lakes fresh to brisk south to southwest winds, with local rains and thunder squalls, during the next twenty-four hours.

The anticipated thunderstorms were not severe, except over extreme southern Lake Michigan and in the neighborhood of Chicago, where a day of intense heat was followed, about 7 p. m., by a fall in temperature of 25° in twenty minutes and a rather severe squall of wind and rain. The morning local forecast for Chicago and vicinity was:

> Conditions will be favorable for thunderstorms, squalls, and lower temperature to-night.

The forecasts were verified in detail.

Although high temperature prevailed in the corn and wheat growing districts during the remainder of the month, local rains, which were copious in localities, prevented a reestablishment of the drought conditions which were developed prior to the 19th.

An extraordinary fall of hail attended a thunderstorm at Chicago the evening of the 28th. Hail, varying in size from one-half to two inches in diameter and one-fourth to one-half inch in thickness, fell in a comparatively narrow belt which crossed the city from west-southwest to east-northeast, covering the business center and causing considerable damage, principally to window glass.—*E. B. Garriott, Professor and Forecast Official.*

FORECASTS AT SAN FRANCISCO, CAL.

No wind signals were ordered from this station during the month.

WARNINGS OF UNUSUAL WEATHER CONDITIONS.

The only injurious conditions that occurred during July, 1898, were "northers" on the 15th and 26th, both of which were satisfactorily forecast on the previous day, and information furnished to all interested. The "norther" of July 25 was followed by a period of extremely high temperature throughout the interior of the State.— *W. H. Hammon, Local Forecast Official.*

FORECASTS AT PORTLAND, OREG.

No wind-signal orders were issued during the month, as there were no storms.

The "summer type" of weather conditions did not appear until the 7th, and even then the type was indistinct and not perfect in its movement. The areas of low pressure continued central too long over southeastern Oregon, and the areas of high pressure, in their eastward course, moved too much to the southeast. The movement of the highs, from the 21st to the close of the month, approximated closer to the summer type than any former ones this year. The movement of the summer highs has a relation to the movement of the lows in winter. When this relation is clearly defined, seasonal forecasts are possible. Under the influence of the summer highs, forecasts for several days are made with accuracy. Such forecasts are appreciated and are of value to the people. July and August are dry months, and the forecasts for thirty-six hours are not as valuable as in the other ten months of the year. The general information issued concerning crops, the wheat service reports, etc., are deemed of greater value during the dry season than any other information issued, though the weather and temperature forecasts, when marked changes occur, are of direct value. The output of ice factories and the shipment of frozen salmon and perishable produce are guided to a very great extent by the forecasts during heated periods. During the month resorts at the Beach and the steamers on the Willamette and Columbia rivers requested information upon which to base their operations.— *B. S. Pague, Local Forecast Official.*

AREAS OF HIGH AND LOW PRESSURES.

The tracks of six highs and the same number of lows were sufficiently well defined to be mapped on Charts I and II. On these charts are given the approximate position of the center of high or low twice each day, and also the barometer reading at the point nearest that center. The accompanying table presents a few facts as to the region of origin and disappearance, the length of path, and the velocity of the high or low. The following is a general description:

Highs.—The principal point of interest in the highs of this month has been their origin off the Pacific coast. In the case of IV, V, and VI, they were first noted off the south Pacific coast, and first moved up the coast before appearing on the land and moving to the interior. Highs I and II may have had such a motion, but the observations are too close to land to show it. Such motion has been noted in several months previously, and seems rather significant, though observations will be needed at sea in order to show the complete trajectory and surrounding pressure conditions giving rise to such a motion. The general track of the highs was in rather high latitudes. Highs I, II, and IV were last seen off the north Atlantic coast, III and VI disappeared off the south Atlantic coast, and V in the upper Lake region.

Lows.—All the lows began to the north of Montana and moved mostly to the north of the United States. No. I disappeared in Iowa, and the rest in or near the Gulf of St. Lawrence. The thunderstorms of the month, as reported by telegraph, culminated as follows: 3d, 23; 8th, 28; 17th, 26; 19th, 27; 23d, 25; 25th, 29; 28th, 23; 29th, 26; and 30th, 24. These storms occurred either in the southeast quadrant of a low or between two highs, or in a disturbed region showing a combination of these conditions.

The highest winds of the month were as follows: As low II passed into the Gulf of St. Lawrence a squall of 44 miles an hour occurred at Atlantic City, p. m. of 4th. On a. m. of 13th a squall of 60 miles an hour occurred at Sandy Hook. The storm in this case was off the New Jersey coast. On p. m. of 19th Green Bay had a thunderstorm squall of wind reaching 48 miles, and on 20th, p. m., Cleveland reported a squall wind of 52 miles.—*H. A. Hazen, Professor.*

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	1, a.m.	47	126	6, p.m.	42	65	3,570	5.5	649	27.0
II	6, a.m.	48	128	13, p.m.	47	60	3,750	7.5	500	20.8
III	13, a.m.	43	81	17, p.m.	24	81	2,160	4.5	480	20.0
IV	16, a.m.	37	124	24, p.m.	41	68	4,830	8.5	562	23.4
V	21, p.m.	42	127	26, p.m.	45	89	2,400	4.5	533	22.2
VI	27, a.m.	50	124	†2, p.m.	31	79	3,030	6.5	458	19.1
Total							19,740	37.0	3,182	
Mean of 6 paths							3,290		530	22.1
Mean of 37 days									534	22.2
Low areas.										
I	*29, a.m.	32	113	2, a.m.	43	94	1,530	3.0	510	21.2
II	1, p.m.	53	116	4, a.m.	48	53	2,880	2.5	1,152	48.0
III	3, p.m.	51	115	9, p.m.	47	64	2,850	6.0	475	19.8
IV	16, p.m.	51	111	21, a.m.	52	67	2,370	4.5	527	22.0
V	23, a.m.	53	109	26, a.m.	49	61	2,220	3.0	740	30.8
VI	24, p.m.	52	118	30, a.m.	51	62	2,940	5.5	535	22.3
Total							14,790	24.5	3,939	
Mean of 6 paths							2,465		656	27.3
Mean of 24.0 days									604	25.2

*June. †August.

RIVERS AND FLOODS.

Except in the North and Middle Atlantic States the stages of rivers throughout the country during July, 1898, were slightly in excess of the usual summer condition.

In the Hudson and Susquehanna rivers the water reached the lowest point of the season, and at times navigation was seriously interrupted. The reverse condition, however, prevailed in the South Atlantic and Gulf States, where frequent, and in some instances heavy, rains occurred, forcing the stagnant streams to higher stages, and allowing a resumption of navigation, which on some of the streams had for several months been suspended. In the upper Ohio the same conditions prevailed as in the Hudson and Susquehanna and navigation was seriously impeded; but a most opportune season of rain raised the water in the lower Ohio sufficient to enable boats to make regular schedules. The Mississippi, Tennessee, Arkansas, and Red rivers, while generally on the decline, had good navigable stages throughout the month.

In the Missouri River section heavy rains prevailed, which prevented the river from falling to the normal summer stage, and although the flood stage was not reached, the river at Omaha, on the 3d, registered 14.7 feet, the highest recorded so far this year.

The highest and lowest water, mean stage, and monthly range at 118 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on the Chart. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville,

on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

For fuller details see Monthly Bulletin of the River and Flood Service for July, 1898.—*F. W. Krichelt.*

Heights of rivers referred to zeros of gauges, July, 1898.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.	1,957	14	6.9	13	3.9	29,30	5.1	3.0
Reeds Landing, Minn.	1,887	12	4.1	1-3	2.0	31	3.4	2.1
La Crosse, Wis.	1,822	12	5.9	1	3.1	31	4.6	2.8
North McGregor, Iowa	1,762	18	7.1	1	2.8	31	4.6	4.3
Dubuque, Iowa	1,702	15	7.2	1	2.8	31	4.6	4.4
Leclaire, Iowa	1,612	10	5.2	1	1.6	31	3.2	3.6
Davenport, Iowa	1,596	15	6.7	1	2.8	30,31	4.2	3.9
Galland, Iowa	1,475	8	4.2	1	1.5	31	2.4	2.7
Keokuk, Iowa	1,466	14	7.2	1	2.3	31	4.0	4.9
Hannibal, Mo	1,405	17	8.5	1	3.8	31	5.4	4.7
Grafton, Ill	1,307	23	12.5	1	5.3	24,25	8.0	7.2
St. Louis, Mo.	1,264	30	23.2	1,2	10.7	29,30	16.4	12.5
Chester, Ill.	1,189	30	18.2	2	7.8	30	12.9	10.4
Cairo, Ill	1,073	45	25.4	2	12.5	27	18.7	12.9
Memphis, Tenn	843	33	18.2	4,5	7.7	29	13.3	10.5
Helena, Ark	767	42	26.2	6	12.5	30	20.3	18.7
Arkansas City, Ark.	635	42	28.3	8	14.5	28	22.3	13.8
Greenville, Miss	595	42	23.1	8	11.6	29	18.4	11.5
Vicksburg, Miss	474	45	27.0	1	13.4	31	21.8	13.6
New Orleans, La	108	16	10.5	1	4.5	31	7.7	6.0
Arkansas River.								
Wichita, Kans.	730	10	3.4	1	7.6	25,29	2.2	1.8
Fort Smith, Ark.	345	22	11.8	2	4.1	22	7.0	7.7
Dardanelle, Ark.	250	21	12.0	26	4.3	24	7.2	7.7
Little Rock, Ark.	170	23	12.5	4,5	5.8	25	8.9	6.7
White River.								
Newport, Ark	150	25	6.7	26	3.6	19	4.8	3.1
Des Moines River.								
Des Moines, Iowa	150	19	3.8	1-4	2.8	24-28; 30,31	3.2	1.0
Illinois River.								
Peoria, Ill.	135	14	9.1	1	3.5	24	5.5	5.6
Missouri River.								
Bismarck, N. Dak.	1,201	14	10.8	1	5.5	31	7.8	5.3
Pierre, S. Dak.	1,006	14	10.4	1	5.6	31	7.6	4.8
Sioux City, Iowa	676	19	14.7	1,2	10.1	31	12.3	4.6
Omaha, Nebr.	561	18	14.7	3	10.6	31	12.2	4.1
St. Joseph, Mo.	373	10	10.2	4	5.6	27,28	7.7	4.6
Kansas City, Mo.	280	21	19.7	5	11.9	28	15.5	7.8
Boonville, Mo.	191	20	16.9	1	10.2	29,30	13.5	6.7
Hermann, Mo.	95	24	17.2	1	9.8	31	13.3	7.4
Ohio River.								
Pittsburg, Pa	966	22	6.5	30	5.0	8	5.7	1.5
Davis Island Dam, Pa.	950	25	5.5	1	2.0	17	3.1	3.5
Wheeling, W. Va.	875	36	5.5	2	1.7	15,20	3.1	2.7
Parkersburg, W. Va.	785	36	7.0	3	2.8	16	4.7	4.2
Point Pleasant, W. Va.	703	39	5.6	30	2.1	15,17	3.5	3.5
Catlettsburg, Ky	651	50	8.4	31	3.3	15,16	5.5	5.1
Portsmouth, Ohio	612	50	9.6	27	4.2	15	6.7	5.4
Cincinnati, Ohio	499	50	11.0	27	6.1	17	8.6	4.9
Louisville, Ky.	367	28	6.0	29-31	3.8	17,18	5.0	2.2
Evansville, Ind	184	35	11.2	1	4.4	20,21	6.4	6.8
Paducah, Ky.	47	40	12.3	1,2	3.5	22	7.0	8.8
Allegheny River.								
Warren, Pa	177	7	2.0	1	0.0	24-27	0.6	2.0
Oil City, Pa	123	13	3.0	1	0.5	18-26	1.0	2.5
Parkers Landing, Pa.	73	30	2.5	1	0.3	24,25	0.9	2.2
Freeport, Pa.	26	20	5.0	1	0.8	18,19	1.6	4.2
Conemaugh River.								
Johnstown, Pa.	64	7	1.7	2	0.8	14,15,17	1.2	0.9
Red Bank Creek.								
Brookville, Pa.	35	8	0.8	1	0.2	18	0.3	0.6
Beaver River.								
Ellwood Junction, Pa.	10	14	2.0	25	−1.5	24	−0.4	3.5
Cumberland River.								
Burnside, Ky	434	50	4.8	30	−0.1	14,15	1.1	4.9
Carthage, Tenn.	257	30	5.0	30	0.8	16-19	1.7	4.2
Nashville, Tenn	175	40	7.2	27,28	1.5	14	33.0	6.7
Great Kanawha River.								
Charleston, W. Va.	61	30	7.6	30	6.2	14-17	6.8	1.4
New River.								
Hinton, W. Va.	95	14	3.1	29	1.0	14	1.7	2.1
Licking River.								
Falmouth, Ky.	30	25	6.0	26	1.1	14-16	2.5	4.9
Miami River.								
Dayton, Ohio	69	18	1.9	27,28	1.1	2,3,14,15	1.5	0.8
Monongahela River.								
Weston, W. Va	161	18	0.6	21	−1.0	3-5,8-13; 15,16	−0.5	1.6
Fairmont, W. Va	119	25	1.8	20	−0.3	15-17	0.7	2.1
Greensboro, Pa.	81	18	8.0	19	6.3	14	7.1	1.7
Lock No. 4, Pa.	40	28	9.7	20	6.8	18	8.3	2.9
Cheat River.								
Rowlesburg, W. Va.	36	14	5.0	19	0.5	13-16	1.8	4.5

Heights of rivers referred to zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Youghiogheny River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Confluence, Pa.	59	10	4.0	18	0.9	13,14	1.7	3.1
West Newton, Pa.	15	25	3.0	19	0.0	10-15,29	0.4	3.0
Muskingum River.								
Zanesville, Ohio	70	20	8.5	28	6.0	7-10	7.1	2.5
Tennessee River.								
Knoxville, Tenn.	614	29						
Kingston, Tenn	534	25	4.2	31	0.4	8	1.4	3.8
Chattanooga, Tenn	430	33	7.7	31	2.1	4	3.6	5.6
Bridgeport, Ala	390	24	4.3	31	0.8	5,7,8	1.9	3.5
Florence, Ala	220	16	3.8	41	0.7	7-11	1.5	3.1
Johnsonville, Tenn	94	21	4.6	30,31	1.4	16	2.7	3.2
Clinch River.								
Speers Ferry, Va.	156	20	5.0	28	0.3	3	1.2	4.7
Clinton, Tenn	46	25	12.5	30	3.8	17,20	5.5	8.7
Wabash River.								
Mount Carmel, Ill	50	15	3.0	1-6	1.6	29-31	2.5	1.4
Red River.								
Arthur City, Tex.	688	27	11.4	1	5.3	16	7.0	6.1
Fulton, Ark	565	28	13.2	1	4.7	30	6.9	8.5
Shreveport, La.	449	29	11.6	3,4	5.0	31	8.4	6.6
Alexandria, La	139	33	12.1	2	4.7	30,31	8.3	7.4
Atchafalaya Bayou.								
Melville, La	100*	31	26.4	1	16.6	31	22.8	9.8
Ouachita River.								
Camden, Ark.	340	30	6.3	2	4.2	21	5.1	2.1
Monroe, La	100	40	12.8	1	2.2	24	6.1	10.6
Yazoo River.								
Yazoo City, Miss.	80	25	5.2	10	1.8	27,28	2.9	3.4
Chattahoochee River.								
Columbus, Ga.	140	30	9.0	31	−0.7	4-6	2.9	9.7
Flint River.								
Albany, Ga.	80	30	4.6	18,19	2.4	9,10,12,30	3.3	2.2
Cape Fear River.								
Fayetteville, N. C.	100	38	16.2	8	1.0	5	5.9	15.2
Columbia River.								
Umatilla, Oreg	270	25	18.8	1	12.0	31	15.2	6.8
The Dalles, Oreg	166	40	31.9	1	19.1	31	24.7	12.8
Willamette River.								
Albany, Oreg	99	30	2.0	1-3	1.0	16-31	1.4	1.0
Portland, Oreg	10	15	18.0	1	10.0	30,31	13.2	8.0
Edisto River.								
Edisto, S. C	75	6	4.9	16	0.4	3,4	2.9	4.5
James River.								
Lynchburg, Va.	257	18	1.6	29	0.0	6,13,15,16	0.6	1.6
Richmond, Va.	110	12	2.8	28	−0.2	5,14-17	0.4	3.0
Alabama River.								
Montgomery, Ala	265	35	4.2	16,17,31	−0.3	4-8	1.7	4.5
Selma, Ala.	212	35	5.4	18	−0.9	7,8	1.8	6.3
Coosa River.								
Rome, Ga.	225	30	4.2	29,31	1.0	2-5	2.3	3.1
Gadsden, Ala	144	18	4.8	31	−0.3	5-8	1.2	5.1
Tombigbee River.								
Columbus, Miss.	285	33	−0.2	25	−2.6	15	−1.7	2.4
Demopolis, Ala.	155	35	2.4	29,31	−1.2	15	0.1	3.6
Black Warrior River.								
Tuscaloosa, Ala.	90	38	2.9	31	−0.2	17	0.8	3.1
Pedee River.								
Cheraw, S. C.	145	27	8.0	8	0.4	5	2.5	7.6
Black River.								
Kingstree, S. C.	60	12	7.3	20	3.6	8	5.7	3.7
Lumber River.								
Fairbluff, N. C.	10	6	2.3	20	−0.6	6-8	0.7	2.9
Lynch Creek.								
Effingham, S. C	35	12	7.9	15	2.1	5,6	4.1	5.8
Potomac River.								
Harpers Ferry, W. Va.	170	16	2.6	31	0.4	19-21	0.9	2.2
Roanoke River.								
Clarksville, Va	155	12	2.4	29,30	0.0	4,5	0.9	2.4
Sacramento River.								
Red Bluff, Cal.	241	23	0.1	1-3	−0.6	28-31	0.2	0.7
Sacramento, Cal.	70	25	8.8	1,2	7.6	23-31	8.0	1.2
Santee River.								
St. Stephens, S. C.	50	12	7.1	14-20	−1.3	8	4.4	8.4
Congaree River.								
Columbia, S. C.	37	15	8.8	13	1.0	2-4	2.3	2.8
Wateree River.								
Camden, S. C	45	24	15.5	8	0.9	5	6.4	14.6
Savannah River.								
Augusta, Ga.	130	32	17.7	25	3.3	6	9.6	14.4
Susquehanna River.								
Wilkesbarre, Pa.	178	14	0.0	1-8	−0.4	18-30	−0.2	0.4
Harrisburg, Pa.	70	17	2.2	2	0.7	18,19	1.2	1.5
Juniata River.								
Huntingdon, Pa.	80	24	3.3	29	2.8	7-26	2.9	0.5
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	2.0	1	0.5	17-20	0.9	1.5
Waccamaw River.								
Conway, S. C	40	7	2.5	13-14	0.5	1	1.7	2.0

*Distance to Gulf of Mexico.

THE WEATHER OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The statistical aspects of the weather of the month are presented in the tables which form the closing part of this REVIEW. Table I, in particular, contains numerous details that are important in the study of climatology. The numerical

values in the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to VII, inclusive.

PRESSURE AND WIND.

Normal conditions.—The geographic distribution of normal barometric readings at sea level and under local gravity for July is shown by Chart V of the MONTHLY WEATHER REVIEW for July, 1893.

Normal pressure in July is highest over the south Atlantic and north Pacific coasts and lowest over Arizona and the Plateau region. As compared with June there is a very general increase, especially in southern latitudes and along the eastern foothills of the Rocky Mountains.

Normal pressure on the south Atlantic coast and over the interior of the continent increases steadily from July to January when the characteristic winter distribution is fully developed.

The prevailing winds, except on the Pacific coast, are generally from a southerly quarter—southwesterly in New England and the lower Lake region, southerly in the Mississippi Valley and on the south Atlantic and Gulf coasts, and southeasterly on the Plains. On the Pacific coast the general tendency is to blow from some westerly quarter.

The current month.—The distribution of monthly mean pressure, as shown by Chart IV, presents no unusual features. Pressure was above normal in New England, the Middle and South Atlantic States, the Lake region, Ohio Valley and Tennessee, the upper Mississippi Valley, North Dakota, and the middle Plateau; elsewhere it was generally below normal, although there were no marked departures in any district.

The changes from June to July were large over New England, the Lake region, the middle Mississippi Valley, and the lower Missouri Valley. Pressure has steadily increased over New England and the Lake region since May last.

The prevailing winds on the Atlantic coast were southerly or southwesterly, except on the Florida peninsula, where southeasterly winds prevailed. In the west Gulf States, upper Mississippi and Missouri Valleys, southerly or southeasterly winds were most frequent. Northerly and northwesterly winds prevailed on the Pacific coast and the upper Lakes; elsewhere the winds were generally from a southerly quarter.

TEMPERATURE OF THE AIR.

Normal conditions.—The normal mean temperature of the air in the United States in July varies from about 84° at Key West, 82° at Jacksonville, 82° at New Orleans, 84° at Galveston, 67° at San Diego, to 60° at Eastport, 71° at Burlington, 70° at Buffalo, 72° at Detroit, 66° at Duluth, 66° at St. Vincent, 67° at Havre, 69° at Spokane, and 63° at Seattle, on Puget Sound. The warmest regions are the lower Rio Grande Valley and southwestern Arizona, including a portion of the desert region of California. The seacoast is cooler than the interior on corresponding parallels. The coldest portion of the United States is the region about Lake Superior.

In studying the distribution of monthly mean temperatures it will be found very helpful to consult the charts at the end of this REVIEW, especially No. VI, Surface Temperatures, Maximum, Minimum, and Mean. This chart gives a very good idea of the variations of temperature with latitude and longitude, and also of the distribution of normal surface temperatures. Chart VI for any month will differ from a normal chart merely in the displacement or bending of the isotherms northward or southward according as the temperature of the particular locality is above or below the normal for the place and season.

The current month.—The month had several features that deserve mention; first was the period of high temperature extending from the 1st to the 5th; second, the low temperature and frost in New York, northern New England, northern Ohio, and the northern part of the lower peninsula of Michigan, and, finally, the great range of temperature during the month.

Unusually high temperature prevailed over the region extending from the Lakes eastward and southeastward to the Atlantic from the 1st to the 5th. The thermometer readings at Washington, Baltimore, Philadelphia, New York, Albany, Portland, and Eastport were as high or higher than have been registered in the first ten days of July during the last twenty-seven years, and many other stations reported temperatures within a few degrees of the highest ever before recorded. The air was relatively dry during the hot spell and there was not so much suffering as might have been the case. The casualties due to excessive heat were greatest on July 1, on which date, according to press reports, there were 2 deaths and 36 prostrations in New York City; 3 deaths and 16 prostrations in Chicago, with a few scattered cases elsewhere. Cooler weather prevailed in the Lake region on the 3d, and by the morning of the 5th lower temperatures prevailed eastward to the coast.

While the temperature was abnormally high in the region above mentioned, the weather on the north Pacific coast was unusually cold for the season. The highest point reached by the thermometer during the first ten days of the month at Eureka, Cal., was 58°; Fort Canby and Port Angeles, Wash., 68°; San Diego, Cal., 73°; Portland, Oreg., 83°, and San Francisco, Cal., 88°. The temperature of the northern slope and the northern plateau was also much below the normal. During the first week of July the daily mean temperature was 12° below the normal at Helena and a less amount at other stations in that region.

The lowest temperature of the month in the lower Lake region, the Ohio Valley, the Middle Atlantic States, and New England was recorded on the 10th, 11th, and 12th. Frost severe enough to kill corn and vegetables, a very unusual occurrence during July, was observed on the upper portion of the lower peninsula of Michigan, the northern part of Ohio, western New York, northern New England, and in portions of New Jersey. The minimum temperature at a few places in the above named territory was lower than ever before recorded during the first ten days of July. Low temperature for the season prevailed southward to the Gulf. At Washington, D. C., a minimum of 54° was recorded on the 11th, 53° being the lowest recorded in July during the last twenty-seven years. At Baltimore the minimum temperature fell to within 2° of the lowest ever before recorded in July.

The monthly range of temperature in the Lake region and the Middle Atlantic States was unusually large, as may be seen by an inspection of the data in Table I.

The close of the month on both the eastern and western coasts was marked by a period of warm weather. On the eastern coast the thermometer readings were not unusually high, but there was sufficient moisture in the air to produce more or less bodily discomfort. The relative humidity on the first and last four days of the month, respectively, is exhibited in the following table:

Relative humidity at Washington, Philadelphia, and New York.

	July.									
	1st.	2d.	3d.	4th.	Mean.	28th.	29th.	30th.	31st.	Mean.
	%	%	%	%	%	%	%	%	%	%
Washington	63	62	56	72	63	92	78	69	75	78
Philadelphia	60	58	58	75	63	81	80	67	79	77
New York	54	63	63	84	66	97	89	87	87	90

A few prostrations were reported in the Lake region on the 15th, 17th, 18th, 19th, 24th, 25th, and on the eastern seaboard on the 21st and 29th.

Three casualties due to excessively hot weather were reported from Arizona on the 28th (Arizona Gazette, July 30, 1898). The latter are of more than passing interest. The temperature and humidity at Phenix, where the fatalities occurred, were as follows: July 28, maximum temperature, 110°; minimum, 85°; relative humidity, 5 a. m., local time, 42 per cent; 5 p. m., 17 per cent.

The temperature of the month as a whole was 1° to 4° above the average in the Lake region, New England (except the Maine coast), the Ohio Valley and Tennessee, the upper Mississippi and Missouri valleys. It was also slightly above the average over the greater part of the Plateau region. Elsewhere temperature was normal or below, but generally the deficits were small.

The average temperatures of the respective geographic districts, the departures from the normal of the current month and from the general mean since the first of the year, are presented in the table below for convenience of reference:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	68.4	+ 0.2	+ 7.3	+ 1.0
Middle Atlantic	12	70.3	+ 1.7	+10.3	+ 1.5
South Atlantic	10	80.0	+ 0.1	+ 6.1	+ 0.9
Florida Peninsula	7	81.7	+ 0.2	+28.0	+ 0.4
East Gulf	7	80.5	− 0.6	+ 4.3	+ 0.6
West Gulf	7	81.6	− 0.3	+10.2	+ 1.5
Ohio Valley and Tennessee	12	78.1	+ 1.3	+12.7	+ 1.8
Lower Lake	8	73.4	+ 2.2	+19.5	+ 2.8
Upper Lake	9	68.6	+ 1.3	+20.7	+ 3.0
North Dakota	7	67.8	− 0.7	+22.4	+ 3.2
Upper Mississippi	11	75.4	+ 0.2	+17.3	+ 2.5
Missouri Valley	10	75.0	− 0.3	+19.1	+ 2.7
Northern Slope	7	69.0	− 0.6	+ 7.5	+ 1.1
Middle Slope	6	76.1	− 0.4	+ 8.8	+ 1.3
Southern Slope	5	78.3	− 1.9	+ 6.5	+ 0.9
Southern Plateau	13	79.5	0.0	− 0.7	− 0.1
Middle Plateau	9	73.1	+ 1.0	− 6.0	− 0.9
Northern Plateau	11	69.5	+ 0.1	+ 5.2	+ 0.7
North Pacific	9	62.0	+ 0.4	+ 5.7	+ 0.8
Middle Pacific	5	64.1	− 0.3	− 4.6	− 0.7
South Pacific	4	71.4	+ 0.7	+ 0.9	+ 0.1

The distribution of the observed monthly mean temperature of the air is shown by red lines (isotherms) on Chart VI. This chart also shows the maximum and the minimum temperatures, the former by broken and the latter by dotted lines. As will be noticed, these lines have been drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level; the isotherms relate, therefore, to the average surface of the country in the neighborhood of the various observers, and as such must differ greatly from the sea-level isotherms of Chart IV.

In Canada.—Prof. R. F. Stupart says:

The mean temperature of the month was either equal to or above average in all parts of the Dominion, except the central and more southern portions of Assiniboia. The greatest excess above occurred in Ontario, east of the Georgian Bay and Lake Huron, and north of Lake Ontario, where at some points it was as much as 6°. A marked feature of the month was the unusually large range of temperature; thermometer readings of 90° and upward were recorded at least once in every province, except Prince Edward Island and perhaps Vancouver Island, while, on the other hand, on the 11th in Ontario and on the 20th in Manitoba and the Northwest Territories, ground frosts occurred very generally, and at some few points in Ontario temperatures below 32° were recorded by thermometers four feet above the ground.

PRECIPITATION.

Normal conditions.—The regions of heavy precipitation, 4 to 6 inches in July, are mainly on the Gulf and south Atlantic coasts. There are, however, other areas, in various parts of the interior, which have, according to the present normal charts, an average precipitation of 4 inches and over. Some of these areas, doubtless, appear on the charts as a result of the practice of including months of torrential rains in the general sums and averages of a short series of observations. There present boundaries are, therefore, uncertain.

There is, undoubtedly, a greater tendency to heavy downpours in some localities than in others, but it is difficult at present to delimit the precise areas thus liable to excessive precipitation.

The rainfall of the Pacific coast in July is at its yearly minimum, and summer rains have begun in Arizona and New Mexico.

The region eastward of the one hundredth meridian has a variable summer rainfall. In some part of the territory there is each year total or partial drought. Happily, however, much of the region has an average rainfall in excess of the actual needs of agriculture.

The current month.—More than the average amount of rain fell in 6 out of the 21 districts into which the country has been divided; the fall in 9 was below normal, while in the remaining 6 it was practically normal. On the whole, the month must be classed as one of average rainfall. In the majority of districts where the fall was below normal the deficits were small and no injurious results followed. As frequently happens in July, torrential rains fell in a number of States; in some cases considerable loss of life resulted. The greatest floods occurred in Missouri, there being two localities in which the fall was unusually heavy. On the night of the 6–7th, in Atchison, Nodoway, Holt, and Gentry counties, remarkably heavy rains fell, causing the small streams and rivers to leave their banks, washing away bridges, fences, and growing crops, and also causing great loss to livestock. Various estimates of the damage done were made at the time. In some cases it was placed as high as $300,000; probably half that sum would be nearer the truth. There was no rain gauge in the midst of the greatest downpour. Outlying measurements were as follows: The gauge at Thurman, Iowa, caught 9.70 inches in eight hours and fifty minutes; the Pickering, Mo., gauge caught 8.15 inches of rain in twenty-four hours; at Maryville, about the center of Nodoway County, 6.84 inches were caught. The greatest downpour occurred between 7 p. m. of the 6th and about 2 a. m. of the 7th. Six people were drowned in the floods.

On the night of the 7–8th heavy rain set in at St. Louis, 5.08 inches falling in twenty-four hours, 2.86 of which fell in one hour and two minutes. The cellars and basements in badly drained sections of the city were flooded; damages to the amount of $30,000 were reported to the police. A line of street railway operated by electricity was interrupted by a pool of water forming over a depressed portion of the tracks. The most serious loss of human life occurred at Steelville, in Crawford County, on the early morning of the 8th. Rains had fallen during the day, and set in again at night. The town lies in a valley not more than 300 yards wide, through the center of which Yadkin Creek runs. The inhabitants of the village were suddenly awakened about 3 o'clock in the morning by a flood of water which soon crept up to the second stories of the dwelling houses. In a very short time thirty-five buildings were washed away and many others were badly wrecked. Thirteen people were drowned in the flood. Property loss was estimated at $200,000.

Torrential rains fell in other States, as may be seen by Table XI, but in no other case was there so great destruction of life and property as above noted.

The drought in Florida referred to in previous REVIEWS was effectually broken.

The geographic distribution of precipitation is shown on

Chart III, and the numerical values for about 3,000 stations appear in Tables II and III, while the details as to excessive rains will be found in Table XI.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	3.78	112	+0.40	+ 2.60
Middle Atlantic	12	4.31	100	0.00	− 2.70
South Atlantic	10	8.06	127	+1.70	− 8.10
Florida Peninsula	7	8.31	124	+1.60	−10.90
East Gulf	7	6.25	105	+0.30	−12.60
West Gulf	7	2.14	70	−0.90	− 3.00
Ohio Valley and Tennessee	12	4.01	100	0.00	− 0.10
Lower Lake	8	2.66	87	−0.40	− 1.00
Upper Lake	9	1.88	63	−1.10	− 1.20
North Dakota	7	2.49	89	−0.30	− 1.10
Upper Mississippi	11	3.26	89	−0.40	+ 3.30
Missouri Valley	10	4.16	102	+0.10	+ 3.30
Northern Slope	7	1.51	88	−0.20	+ 0.10
Middle Slope	6	2.77	97	−0.10	+ 3.20
Southern Slope	6	2.76	117	+0.40	− 1.30
Southern Plateau	13	1.77	95	−0.10	− 0.20
Middle Plateau	9	0.23	43	−0.30	− 1.20
Northern Plateau	11	0.40	80	−0.10	− 2.50
North Pacific	9	0.43	52	−0.40	− 5.20
Middle Pacific	5	T.	00	−0.10	− 8.20
South Pacific	4	0.02	100	0.00	− 5.10

In Canada.—Professor Stupart says:

Over the greater portion of Ontario the rainfall was, to a marked degree, deficient, and this was particularly the case between Lakes Ontario and Huron, where it was but a small fraction of the average amount. In counties bordering on the Ottawa the deficiency was not nearly so great in some small districts, notably near Stratford, where heavy rain fell locally during thunderstorms on the 3d, 18th, and 19th. Between Algoma and western Manitoba an average amount fell in most localities, and even a larger amount in some few districts; but west of this again, in the Territories and British Columbia, with the exception of southern Alberta, there was a pretty general deficiency, the rainfall ranging between the average amount and 50 per cent of it. In the upper St. Lawrence Valley and eastern Quebec, and in nearly all parts of the Maritime Provinces it was fully up to the average, districts in western New Brunswick and Cape Breton alone showing a small deficiency.

SNOWFALL.

A measurable amount of snow was recorded at two stations in Montana on the 1st. Snow was general on the mountain ranges of the State on that date.

HAILSTORMS.

The following account of severe hailstorms has been compiled from press dispatches, reports of Climate and Crop section directors, and the statements of regular and voluntary observers:

3d–4th.—The period of unusually high temperature over the Lake region and the Middle Atlantic States during the first part of the month was brought to a close by a series of thunderstorms, in some cases attended by large hail. A loss of $4,000 ($1,500 due to hail and $2,500 to wind) was reported from Detroit. On the 4th Cærnavon Township, Lancaster County, Pa., was visited by an extraordinary hailstorm. The track of the storm was from a quarter to a half mile wide and about 8 miles long. Reliable reports say that after the storm hail covered the ground like snow in winter. On the farms of Milton Yohn and Isabella Baxter there were ridges of hail in the grain fields 2 feet deep. Crops, vegetables, and fruits were utterly ruined. The property loss will probably exceed $20,000.

10th.—Press dispatches report the loss of 2,000 acres of wheat in Springhollow, 7 miles east of Pendleton, Oreg., as a result of heavy hail.

14th.—A hailstorm lasting forty minutes visited Salida, Colo. Small fruits and gardens suffered severely.

28th.—Chicago, Ill., was visited by a violent storm of wind, rain, and hail about 6 p. m. The hail was not general throughout the city, but seemed to be concentrated in a rather narrow path through the business portion. The largest hailstones weighed 11 ounces. The impact of the stones, driven as they were by a 40-mile wind, was very destructive. A conservative estimate of the damage to property by wind and hail places the amount at $250,000. A number of persons were injured by runaways, of which there were several hundred. The Weather Bureau anemometer was pelted severely, 30 indentations on the cups being counted after the storm. Plate glass in show windows was not, as a rule, injured. Window glass, especially in down-town streets, suffered severely, the south side of buildings receiving the greatest injury.

A severe hailstorm occurred 6 miles east of Sycamore, Ill., on the same date as the above.

29th.—Autrain, Mich., was visited by a hailstorm, said to have been the most severe ever experienced.

30th.—Severe thunderstorms, accompanied in some cases by hail, swept over Connecticut.

The following are the dates on which hail fell in the respective States:

Alabama, 3, 14. Arizona, 14, 15, 23. Arkansas, 31. Colorado, 4, 10, 13, 14, 16, 22, 23, 24, 25, 30, 31. Connecticut, 4, 30. Idaho, 1, 13, 14. Illinois, 17, 19, 25, 27, 28, 29. Indiana, 25, 26, 29. Iowa, 18, 19, 27, 29. Kansas, 5, 19, 24, 28, 29, 30. Kentucky, 20, 30. Maine, 28. Maryland, 4. Massachusetts, 4, 21, 29, 30. Michigan, 3, 6, 28, 29, 30. Minnesota, 1, 3, 5, 19, 23, 24, 26, 29. Missouri, 25, 27, 28, 29, 30. Montana, 16, 18, 22, 25, 29, 30. Nebraska, 3, 19, 25, 28, 29, 30. New Hampshire, 2, 21. New Jersey, 4, 9, 31. New Mexico, 2, 7, 8, 9, 15, 16, 17, 19, 27, 29, 31. New York, 4, 10. North Carolina, 4, North Dakota, 5, 21, 23, 26. Ohio, 3, 24, 28, 30. Oregon, 11, 13. Pennsylvania, 4, 9, 22. South Dakota, 5, 6, 7, 17, 21, 22, 23, 26, 27, 29. Tennessee, 12. Texas, 24. Vermont, 19. Virginia, 9, 20. Wisconsin, 8, 10, 12, 13, 16, 18, 19, 30, 31. Wyoming, 8, 10, 12, 13, 16, 30.

Hail was reported on the greatest number of dates in Colorado and New Mexico, 11 each; Wisconsin, 9; and Minnesota, 8. There appears to have been less hail than during the preceding month.

HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in 1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In general the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

The current month.—The average relative humidity by geographic districts and the departures from the normal are shown in the subjoined table. The greatest departures from normal values occurred on the Pacific coast, the southern slope, and the Middle Atlantic States. In the last-named

district the first part of the month was hot, but not unusually humid. The closing part of the month was unusually humid, as has been shown in the section on temperature. The greatest humidity of the month was 93 per cent, at Fort Canby, Wash.; the least, 17 per cent, at Independence, Cal.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	81	+ 2	Missouri Valley	67	0
Middle Atlantic	76	+ 4	Northern Slope	51	− 1
South Atlantic	82	+ 2	Middle Slope	62	+ 1
Florida Peninsula	79	+ 1	Southern Slope	62	+ 4
East Gulf	79	0	Southern Plateau	41	− 1
West Gulf	75	+ 2	Middle Plateau	34	+ 2
Ohio Valley and Tennessee	71	+ 2	Northern Plateau	43	0
Lower Lake	67	− 1	North Pacific Coast	71	− 6
Upper Lake	71	0	Middle Pacific Coast	62	− 5
North Dakota	66	0	South Pacific Coast	62	− 1
Upper Mississippi Valley	67	− 1			

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of the prevailing pressure on the psychrometer has the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values of the relative humidity for the day; probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic and at 47 by its thermal effects. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table IX for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun for an hour after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table IX for the stations at which instrumental self-registers are maintained.

The percentage of clear sky (sunshine) for all of the stations included in Table I, obtained as described in the preceding paragraph, is graphically shown on Chart VII. The regions of cloudy and overcast skies are shown by heavy shading; an absence of shading indicates, of course, the prevalence of clear, sunshiny weather.

The formation of fog and cloud is primarily due to differences of temperature in a relatively thin layer of air next to the earth's surface. The relative position of land and water surfaces often greatly increases the tendency to form areas of cloud and fog. This principle is perhaps better exemplified in the Lake region than elsewhere, although it is of quite general application. The percentage of sunshine on the lee shores of the Lakes is always much less than on the windward shores. Next to the permanent influences that tend to form fog and cloud may be classed the frequency of the passage of cyclonic areas.

The current month.—The month was one of less cloudiness and consequently of greater sunshine than usual, except on the immediate Pacific coast and in the South Atlantic States. The regions of least sunshine during the current month, strangely enough, were central Alabama, northwestern Georgia and on the immediate Pacific coast. The regions of the greatest sunshine were in the great valley of California and the Southwest, although the summer rains of Arizona and New Mexico diminished the sunshine of that region from what it was during the preceding month. At Santa Fe there was but 37 per cent of sunshine; at Red Bluff there was 99 per cent, or practically continuous sunshine.

Averages and departures by districts are given in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.5	+0.6	Missouri Valley	4.0	−0.4
Middle Atlantic	5.2	+0.4	Northern Slope	3.7	−0.1
South Atlantic	5.8	+0.8	Middle Slope	3.7	−0.3
Florida Peninsula	4.4	−0.6	Southern Slope	3.6	−0.2
East Gulf	5.4	+0.4	Southern Plateau	3.5	+0.2
West Gulf	4.7	+0.5	Middle Plateau	2.1	+0.1
Ohio Valley and Tennessee	5.0	+0.4	Northern Plateau	2.5	+0.6
Lower Lake	4.2	−0.3	North Pacific Coast	3.4	−1.0
Upper Lake	3.8	−0.9	Middle Pacific Coast	2.8	−0.1
North Dakota	3.7	−0.6	South Pacific Coast	2.0	−0.7
Upper Mississippi Valley	3.7	−0.6			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	28	54	n.	Cleveland, Ohio	20	52	w.
Atlanta, Ga	27	52	sw.	Dubuque, Iowa	19	56	nw.
Atlantic City, N. J	13	50	ne.	Huron, S Dak	5	58	s.
Block Island, R. I	13	60	ne.	Kansas City, Mo	27	50	nw.
Fort Canby, Wash	16	50	se.	Marquette, Mich	19	52	sw.

LOCAL STORMS.

The severest storm of the month occurred in Lafayette and Johnson counties, Mo., on the evening of the 29th. More than 100 buildings were destroyed in its course of about 25

miles, and 18 persons were injured, 2 of whom have since died. The storm was first observed in the vicinity of Odessa, Lafayette County. It was not severe at first, but as it moved southeastward, spreading out in fan shape, several funnel clouds, each with its system of whirling winds, seemed to develop. Ordinarily, tornado clouds move from the southwest to the northeast, but in this case the movement was from the northwest to the southeast, parallel to and in the midst of the general thunderstorm cloud. The latter, when last observed, had a width of about 12 miles. Earlier in the day a severe tornado was observed in the southeastern part of Buchanan County, about 40 miles northwest of Odessa. In this case the resultant direction was also southeast.

The month brought with it the usual number of local squall winds and thunderstorms, only the most severe of which are noted in the list below:

2d.—Batesville, Ark.: A storm of wind and rain struck the town at 6 p. m. Shade trees, roofs, and porches were demolished. The end of a brick office building was torn out, the débris falling upon and killing one person and severely injuring another; property loss, $2,500.

4th.—Hampton Beach, N. H., and Longbeach, Queens County, N. Y. A severe local whirlwind or minor tornado struck both places on the afternoon of the 4th. At the first named place about 20 cottages were more or less injured and a skating rink, where a number of people had congregated, was badly wrecked; 5 persons were killed at the rink and many others severely injured. A pleasure yacht that happened to be in the course of the storm as it passed out to sea was capsized and 5 persons were drowned. The Longbeach storm seems to have been an overgrown whirlwind that had power enough to lift a frame building two and one-half stories in height, 120 feet long and 30 feet wide, from its foundation; the building was moved about 40 feet by the wind and badly wrecked; 8 colored waiters were injured in the wreck; property loss about $6,000.

11th.—The Missouri Valley Journal of July 14 reports the destruction of a store building, barn, and sheds by tornado west of Chamberlain, S. Dak., on the 11th. The report can not be verified.

13th.—A tornado occurred near Warrenton and Norwood, Ga., 4:30 p. m., central time; 1 person killed, 2 injured; property loss, $3,000; path from 50 to 200 yards wide; length, 12 miles; moved a little west of north.

15th.—A severe windstorm damaged, and in some cases, destroyed roofs of buildings and fences in Gila Bend, Ariz.

17th.—Globe, Ariz., was visited by a windstorm severe enough to wreck two partially completed buildings, and 2 persons were injured by the débris.

19th.—Central and eastern Iowa, northern Illinois, southern Wisconsin, and portions of Michigan were visited by severe squall winds and thunderstorms on the afternoon and evening of the 19th. Barns, fences, windmills, and other farm property suffered damage. The loss in individual cases was generally small, but in the aggregate a large loss must have been sustained.

21st.—Severe thunderstorms were experienced in eastern Pennsylvania, New Jersey, and New England in the evening of this date. Thirteen dwellings, 12 barns, and 1 church were struck by lightning in New Jersey.

Seventeen buildings were partially wrecked and 7 persons injured at Minot, N. Dak., on the same date. The storm moved from northwest to southeast; property loss, $5,000. Probably a straight wind.

27th.—A small tornado having its origin near Hastings, Mills County, Iowa, moved eastward in a narrow path, lifting at intervals, and finally disappearing west of Redoak, Montgomery County, Iowa. Length of path, about 15 miles; 2 persons were killed and 3 injured; property loss, $10,000 to $12,000. Many funnel clouds were observed, all being very destructive whenever they touched the earth.

Severe local storms occurred elsewhere in Iowa, also in Indiana, Illinois, Michigan, Missouri, and New Mexico.

29th.—Two sections of northwestern Missouri were visited by severe local storms and tornadoes on the afternoon and evening of this date. The first storm had its origin near Faucett, Buchanan County. It moved eastward and then southeastward, disappearing in the vicinity of Gower, Clinton County, about 10 miles from its origin. This tornado was very destructive. Two persons were severely injured, and many escaped injury and possibly death by taking refuge in tornado caves. The Democrat-Lever, of Gower, places the property loss at $75,000.

The second storm was first observed at Odessa, Lafayette County, Mo., whence it moved to the southeast, increasing in violence and spreading out in the shape of a fan as it advanced. At Tabo, 8 miles southeast of Odessa, two funnel clouds were observed moving, it was said, to the northeast. At Hoffman, a few miles south of Tabo, the funnel cloud was reported as moving from the northwest to the southeast, and the same direction was observed at Knobnoster, about 17 miles southeast of Tabo. Eighteen persons were injured, two of them having since died. The property loss was estimated at amounts varying from $50,000 to $100,000. Probably $75,000 is not far from the true figure. Seventy-five buildings were totally or partially demolished at Knobnoster, 36 north of and in the immediate vicinity of Fayetteville, and 2 at Odessa.

30th–31st.—Severe thunderstorms and torrential rains occurred in various parts of New England.

WATERSPOUT.

In the Marine Record of July 28 there is an account of a waterspout seen off Sturgeon Bay, Lake Michigan. The date of the spout is not given. The Editor hopes that any one knowing the date will send it to the Chief of the Weather Bureau, Washington, D. C. The account of the spout given by the captain of the steamer *Otis* is as follows:

> A few moments after the storm struck us we could see the water rise upward, about a quarter of a mile leeward of us, in a whirling column until it was at least 100 feet high. It was funnel-shaped and must have been 30 feet wide at the bottom, the top tapering and hanging over to one side. Above were hungry-looking clouds, through which the lightning darted. The waterspout lasted about twenty-five minutes, when the water gradually subsided. The storm was a furious one for a while, but we rode through it successfully.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Five thousand seven hundred and thirteen reports of thunderstorms were received during the current month as against 5,376 in 1897, and 5,455 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 19th, 436; 30th, 300; 29th, 293; 25th, 280; 4th, 269.

Reports were most numerous from Ohio, 360; Missouri, 298; Colorado, 277; Florida, 258. Thunderstorms occurred in Florida and New Mexico on every day of the month, and in Colorado on every day except one, the 28th. There were 12 thunderstorms reported in California, 32 in Oregon, and 26 in Washington.

Auroras.—The evenings on which bright moonlight must

have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from June 29 to July 7.

The greatest number of reports were received for the following dates: 19th, 11, and 21st, 10.

Reports were most numerous from Ohio, 10; Minnesota, 9.

In Canada.—Auroras were reported as follows: Father Point, 17, 21, 22; Quebec, 5, 6, 21, 22; Montreal, 21; Toronto, 6, 19; Winnipeg, 20; Minnedosa, 13, 17, 19, 20, 21, 22, 23, 24, 25; Qu'Appelle, 19, 20, 21; Banff, 6, 24; Prince Albert, 19, 20, 22, 23.

Thunderstorms were reported as follows: Halifax, 1; Grand Manan, 4, 24; Yarmouth, 4, 5, 9, 15; Charlottetown, 3; Chatham, 3; Father Point, 2, 3, 8, 25, 29; Quebec, 3, 10, 20, 21, 23, 25, 29, 30; Montreal, 3, 8, 18, 19, 20, 23, 25; Rockliffe, 19; Toronto, 3, 8, 17, 19, 25, 28; White River, 2, 7, 8, 14, 17, 18, 20, 23, 28; Port Stanley, 3, 8, 25, 30; Parry Sound, 8, 28; Port Arthur, 2, 5, 6, 7, 14, 22, 27; Winnipeg, 3, 5, 6, 11, 14, 18, 27; Minnedosa, 4, 5, 11, 12, 14, 17, 24, 26; Qu'Appelle, 17; Medicine Hat, 12, 30; Swift Current, 2, 8, 10, 13, 16, 23, 27, 29; Banff, 12, 13, 16, 25; Prince Albert, 1, 5, 17, 29; Bermuda, 24.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 80.0°, or about normal; the highest was 103°, at Hamilton on the 1st, and the lowest, 51°, at Madison on the 12th. The average precipitation was 6.06, or 1.13 above normal; the greatest monthly amount, 11.27, occurred at Eufaula, and the least, 3.95, at Tuscumbia.—*F. P. Chaffee.*

Arizona.—The mean temperature was 83.5°; the highest was 123°, at Fort Mohave on the 28th, and the lowest, 40°, at Prescott on the 19th. The average precipitation was 2.44; the greatest monthly amount, 8.86, occurred at Bisbee, while none fell at Fort Mohave and Yuma.—*W. T. Blythe.*

Arkansas.—The mean temperature was 79.9°, or about normal; the highest was 105°, at Conway on the 22d, and the lowest, 50°, at Fayetteville on the 12th and 13th, and at Oregon on the 11th. The average precipitation was 4.25, or 0.38 below normal; the greatest monthly amount, 13.97, occurred at Pond, and the least, 0.60, at Texarkana.—*E. B. Richards.*

California.—The mean temperature was 81.4°, or about normal; the highest was 124°, at Volcano Springs on the 13th, and the lowest, 27°, at Bodie on the 2d and 25th. The average precipitation was less than 0.01, or 0.04 below normal; the greatest monthly amount, 0.22, occurred at San Jacinto, while no rain fell at more than half of the stations.—*W. H. Hammon.*

Colorado.—The mean temperature was 67.7°, or about 1.0° above normal; the highest was 109°, at Fort Morgan on the 18th, and the lowest, 29°, at Steamboat Springs on the 23d, 29th, and 30th. The average precipitation was 2.14, or 0.07 below normal; the greatest monthly amount, 4.75, occurred at Altman, while none fell at Steamboat Springs.—*F. H. Brandenburg.*

Georgia.—The mean temperature was 79.8°, or nearly normal; the highest was 104°, at Millen on the 1st, and the lowest, 47°, at Diamond on the 12th. The average precipitation was 8.14, or 2.32 above normal; the greatest monthly amount, 15.45, occurred at Leverett, and the least, 4.31, at Americus.—*J. B. Marbury.*

Idaho.—The mean temperature was 66.6°; the highest was 105°, at Nampa on the 11th, and the lowest, 28°, at Gray on the 2d, and at Marysville on the 17th. The average precipitation was 0.39; the greatest monthly amount, 2.00, occurred at American Falls, and the least, trace, at Nampa.—*D. P. McCallum.*

Illinois.—The mean temperature was 75.5°, or about normal; the highest was 102°, at Alexander on the 24th, and the lowest, 41°, at Lanark on the 11th. The average precipitation was 2.93, or 0.82 below normal; the greatest monthly amount, 7.52, occurred at St. John, and the least, 0.29, at Dwight.—*C. E. Linney.*

Indiana.—The mean temperature was 76.4°, or 1.5° above normal; the highest was 102°, at Bright on the 3d, at Salem on the 24th, and at Winamac on the 26th; the lowest was 42°, at Bluffton and Cambridge City on the 11th, and at Winamac on the 10th and 11th. The average precipitation was 3.02, or 0.30 below normal; the greatest monthly amount, 5.55, occurred at Vevay, and the least, trace, at Bedford.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 73.4°, or about normal; the highest was 102°, at Clarinda on the 19th, and at Rock Rapids on the 24th, and the lowest, 42°, at Ames on the 11th, and at Neola on the 31st. The average precipitation was 2.98, or slightly below normal; the greatest monthly amount, 12.88, occurred at Thurman, and the least, 0.55, at Pioneer.—*G. M. Chappel.*

Kansas.—The mean temperature was 77.7°, or 0.6° below normal; the highest was 108°, at Hays and Russell on the 27th, and the lowest, 46° at Hoxie on the 18th. The average precipitation was 3.00, or 0.31 below normal; the greatest monthly amount, 6.80, occurred at Oswego, and the least, 0.38, at Gibson.—*T. B. Jennings.*

Kentucky.—The mean temperature was 77.8°, or 0.9° above normal; the highest was 102°, at Russellville and Williamsburg on the 2d, at Shelby City on the 3d, and at Maysville on the 4th; the lowest was 48°, at Loretto on the 11th, and at Maysville on the 12th. The average precipitation was 4.71, or 0.14 above normal; the greatest monthly amount, 12.10, occurred at Vanceburg, and the least, 0.44 at Irvington.—*G. E. Hunt.*

Louisiana.—The mean temperature was 80.9°, or 0.8° below normal; the highest was 103°, at Liberty Hill on the 21st, and the lowest, 55°, at Robeline on the 14th. The average precipitation was 5.84, or 1.21 above normal; the greatest monthly amount, 11.99, occurred at Clinton, and the least, 2.94, at Plain Dealing.—*E. A. Beals.*

Maryland and Delaware.—The mean temperature was 77.5°, or 2.1° above normal; the highest was 109°, at Boettcherville, Md., on the 3d, and the lowest, 33°, at Deerpark, Md., on the 11th. The average precipitation was 3.65, or 0.80 below normal; the greatest monthly amount, 7.77, occurred at Grantsville, Md., and the least, 1.31, at Cumberland, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 69.9°, or 1.2° above normal; the highest was 101°, at Clinton and Mottville on the 24th, and the lowest, 25°, at Baldwin on the 11th. The average precipitation was 1.57, or 1.02 below normal; the greatest monthly amount, 4.55, occurred at St. Ignace, and the least, 0.15, at Fitchburg.—*C. F. Schneider.*

Minnesota.—The mean temperature was 69.8°, or about normal; the highest was 101°, at Wabasha on the 24th, and the lowest, 38°, at Mount Iron on the 6th, at Koochiching on the 10th, and at Folden on the 18th. The average precipitation was 2.94, or about 0.50 below normal; the greatest monthly amount, 9.40, occurred at Beardsley.—*T. S. Outram.*

Mississippi.—The mean temperature was 80.5°, or 0.8° below normal; the highest was 104°, at Columbus on the 22d, and the lowest, 53°, at French Camp on the 13th. The average precipitation was 5.92, or 2.08 above normal; the greatest monthly amount, 12.91, occurred at Walnutgrove, and the least, 1.57, at Greenville.—*R. J. Hyatt.*

Missouri.—The mean temperature was 76.1°, or 0.5° below normal; the highest was 104°, at Princeton on the 24th, and the lowest, 42°, at Potosi on the 12th. The average precipitation was 5.58, or 1.03 above normal; the greatest monthly amount, 15.06, occurred at Edgehill, and the least, 1.97, at Unionville.—*A. E. Hackett.*

Montana.—The mean temperature was 66.0°, or about 1.0° below normal; the highest was 104°, at Fort Keogh on the 26th, and the lowest, 31°, at Castle on the 2d. The average precipitation was 0.58 above normal; the greatest monthly amount, 3.32, occurred at Yale, and the least, 0.40, at Glendive and Radersburg.—*E. J. Glass.*

Nebraska.—The mean temperature was 74.0°, or more than 1.0° below normal; the highest was 108°, at Bluehill on the 24th, and the lowest, 35°, at Gering on the 5th. The average precipitation was 2.12, or about 1.40 below normal; the greatest monthly amount, 11.53, occurred at Plattsmouth, and the least, trace, at Fairmont and Valparaiso.—*G. A. Loveland.*

Nevada.—The mean temperature was 73.5°, or 0.6° below normal; the highest was 114°, at St. Thomas on the 28th, and the lowest, 34°, at Elko on the 1st. The average precipitation was 0.12, or about half the usual amount; the greatest monthly amount, 0.96, occurred at Panaca, while none fell at many stations.—*R. F. Young.*

New England.—The mean temperature was 70.0°, or 1.2° above normal; the highest was 103°, at Middletown, Conn., on the 3d, and the lowest, 30°, at Flagstaff, Me., on the 12th. The average precipitation was 3.85, or 0.52 above normal; the greatest monthly amount, 10.26, occurred at Providence, R. I., and the least, 0.66, at Eastport, Me.—*J. W. Smith.*

New Jersey.—The mean temperature was 75.3°, or about 2.5° above normal; the highest was 107°, at Somerville on the 3d, and the lowest, 38°, at Charlotteburg on the 11th. The average precipitation was 4.96, or 0.68 above normal; the greatest monthly amount, 11.72, occurred at Asbury Park, and the least, 2.23, at Atlantic City.—*E. W. McGann.*

New Mexico.—The mean temperature was 72.5°, or 1.4° below normal; the highest was 105°, at Deming on the 30th, and the lowest, 37°, at Winsors on the 16th. The average precipitation was 3.86, or 1.18 above normal; the greatest monthly amount, 6.56, occurred at Fort Bayard, and the least, 0.90, at Bernalillo.—*R. M. Hardinge.*

New York.—The mean temperature was 72.5°, or 2.4° above normal; the highest was 103°, at Primrose and Westpoint on the 3d, and the lowest, 32°, at Franklinville, New Lisbon, and South Kortright on the 11th, and at Elizabethtown and Perry City on the 12th. The average precipitation was 2.80, or 1.03 below normal; the greatest monthly amount, 8.90, occurred at Liberty, and the least, 0.60, at Madison Barracks.—*R. G. Allen.*

North Carolina.—The mean temperature was 77.7°, or normal; the highest was 103°, at Goldsboro on the 2d, and the lowest, 49°, at Highlands on the 12th. The average precipitation was 6.98, or about 1.50 above normal; the greatest monthly amount, 15.97, occurred at Highlands, and the least, 1.97, at Goldsboro.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 67.5°, or 1.2° below normal; the highest was 106°, at Medora on the 5th, and the lowest, 28°, at Fort Yates on the 30th. The average precipitation was 2.74, or 0.37 above normal; the greatest monthly amount, 6.30, occurred at Wahpeton, and the least, 0.25, at Minot.—*B. H. Bronson.*

Ohio.—The mean temperature was 76.0°, or 2.8° above normal; the highest was 105°, at Warsaw on the 1st, and the lowest, 38°, at Greenhill and Milligan on the 11th. The average precipitation was 3.98, or 0.40 above normal; the greatest monthly amount, 10.65, occurred at Vanceburg, Adams County, and the least, 1.52, at Jacksonboro.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 80.0°; the highest was 112°, at Purcell on the 8th, and the lowest, 51°, at Burnett on the 12th, and at Prudence and Sac and Fox Agency on the 13th. The average precipitation was 4.44; the greatest monthly amount, 9.82, occurred at Arapaho, and the least, 1.65, at Sac and Fox Agency.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 66.0°, or 0.4° above normal; the highest was 119°, at Prineville on the 29th, the highest temperature ever recorded in Oregon; the lowest was 29°, at the same station on the 7th. The average precipitation was 0.46, or 0.02 below normal; the greatest monthly amount, 1.82, occurred at Government Camp, and the least, trace, at Ella and Umatilla.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 74.8°, or 3.9° above normal; the highest was 107°, at Hamburg on the 3d, and the lowest, 33°, at Shanglehouse on the 11th. The average precipitation was 3.36, or 0.62 below normal; the greatest monthly amount, 6.29, occurred at Point Pleasant, and the least, 1.15, at Williamsport.—*T. F. Townsend.*

South Carolina.—The mean temperature was 80.0°, or 1.2° above normal; the highest was 102°, at Greenwood on the 4th, and the lowest, 54°, at Little Mountain on the 12th. The average precipitation was 7.81, or 1.68 above normal; the greatest monthly amount, 12.99, occurred at Charleston, and the least, 4.72, at Effingham.—*J. W. Bauer.*

South Dakota.—The mean temperature was 71.9°, or about normal; the highest was 112°, at Cherry Creek on the 5th, and the lowest, 32°, at Rochford on the 3d. The average precipitation was 3.06, or 0.15 above normal; the greatest monthly amount, 6.92, occurred at Wessington Springs, and the least, 0.19, at Nowlin.—*S. W. Glenn.*

Tennessee.—The mean temperature was 77.8°, or slightly above normal; the highest was 104°, at Elizabethton on the 2d, and the lowest, 51°, at Erasmus on the 11th, and at Springdale on the 12th. The average precipitation was 5.92, or about 1.25 above normal; the greatest monthly amount, 10.56, occurred at Sewanee, and the least, 2.09, at Covington.—*H. C. Bate.*

Texas.—The mean temperature for the State determined by comparison of 36 stations distributed throughout the State, was 1.2° below the normal. There was a general deficiency, but the deficit was slight in many localities. The highest was 110°, at Fort Ringgold and Fruitland on the 23d, and the lowest, 47°, at Valentine on the 2d. The average precipitation for the State, determined by comparison of 38 stations distributed throughout the State, was 0.08 below the normal. There was a slight excess over the panhandle, the east coast districts, and southwest Texas, while there was a general deficiency elsewhere, but not amounting to more than 1.00 except in a few localities over north Texas. The greatest monthly amount, 5.88, occurred at Breckenridge, while none fell at Rockport.—*I. M. Cline.*

Utah.—The mean temperature was 73.4°; the highest was 115°, at St. George on the 29th, and the lowest, 28°, at Soldier Summit on the 1st. The average precipitation was 0.35; the greatest monthly amount, 1.62, occurred at Levan, and the least, trace, at several stations.—*J. H. Smith.*

Virginia.—The mean temperature was 77.0°, or slightly above normal; the highest was 105°, at Bon Air on the 2d, and at Woodstock on the 3d, and the lowest, 44°, at Dale Enterprise and Hot Springs on the 11th. The average precipitation was 5.33, or 1.72 above normal; the greatest monthly amount, 13.74, occurred at Dwale, and the least, 2.27, at Stephens City.—*E. A. Evans.*

Washington.—The mean temperature was 64.9°, or about normal; the highest was 107°, at Centerville on the 31st, and the lowest, 33°, at Centerville on the 6th, and at Hunters on the 18th. The average precipitation was 0.54, or slightly below normal; the greatest monthly amount, 1.97, occurred at Clearwater, while none fell at several stations in the Yakima Valley.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 75.0°; the highest was 103°, at Martinsburg and Wheeling on the 3d, and the lowest, 40°, at Beverly, Burlington, Dayton, and Uppertract on the 11th, and at New Martinsville on the 12th The average precipitation was 4.46; the greatest monthly amount, 8.33, occurred at Beverly, and the least, 1.53, at Rowlesburg.—*C. M. Strong.*

Wisconsin.—The mean temperature was 70.7°, or slightly above normal; the highest was 101°, at Medford on the 14th, and the lowest, 34°, at Neillsville on the 11th. The average precipitation was 2.87, or slightly above normal; the greatest monthly amount, 5.89, occurred at Westfield, and the least, 0.55, at Bayfield.—*W. M. Wilson.*

Wyoming.—The mean temperature was 67.4°; the highest was 105°, at Bittercreek on the 15th, and the lowest, 30°, at Four Bear on the 2d. The average precipitation was 0.86; the greatest monthly amount, 2.34, occurred at Wheatland, and the least, trace, at Wamsutter.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

CLIMATOLOGY VERSUS METEOROLOGY.

By Prof. MILTON WHITNEY, Chief of Division of Soils.

I have been much interested in reading the criticisms of the recent article of mine[1] contained in the April number of the MONTHLY WEATHER REVIEW, page 168, and that of Mr. R. DeC. Ward in the MONTHLY WEATHER REVIEW for May, page 214. These criticisms have brought out some very interesting additional facts. It is evident, however, that the main purpose of my paper was not clearly understood. The point I wished to make was the distinction between meteorology and climatology in order to emphasize the fact that we are not paying enough attention to the study of climatology. My definition of meteorology would be (*a*) the numerical data as expressed by our instruments of the various atmospheric phenomena at or near the surface of the earth; (*b*) the investigation of the laws of storm, of temperature, humidity, rainfall, light intensity, and other natural phenomena of the kind. Climatology, on the other hand, is the numerical relation of these phenomena as they concern the development of life and of industries as you properly suggested. The collection and tabulation of meteorological data does not meet this definition of climatology, and it is this that I particularly desired to emphasize. From the equation published in Science, it is evident that certain functions of temperature are numerically equal to certain other functions of humidity, wind velocity, and moisture as expressed in the development of plants; that is, in order to maintain a constant condition of plant growth, an increase of a few degrees of temperature must be followed by a fall in the velocity of the wind or by an increase in the humidity of the atmosphere, or by an increase in the moisture supply of the soil. All of these factors have more or less effect, according to the intensity of the heat and actinic effects of the solar radiations.

In calling attention to this it was desired to interest our meteorologists, if possible, in this study of the numerical relations of this phenomenon. We all know that if the

[1] Climatology as distinguished from meteorology. Science, January 25, 1898, VII, p. 113.

temperature increases within limits, the moisture content of the air should increase to maintain the condition of growth constant, and we know that a high temperature and a high wind velocity work together in taxing the powers of a plant. Now, for an increase of 10° in temperature, how much does the relative humidity need to be increased? Or what relation has the wind velocity per hour-mile to a degree in temperature in relation to the development of plants? If we have the same temperature and the same wind velocity over two successive periods, and the normal wind velocity over one, and twice the normal wind velocity over the other of the two periods, the effect upon a growing plant would unquestionably be great. With this increased movement, how much would the temperature need to be lowered in order that the conditions would be the same over each period and the wind not retard the development of the plant?

It seems as though numerical relations of this kind can be established between the principal meteorological elements. These numerical relations of the meteorological elements will unquestionably differ, as stated in my paper, not only for different plants, but for the same plant in different periods of its growth. The equation was intended really to show the variation in the climatic conditions from the normal. In order to use this intelligently of course the normal conditions must be worked out so that departures from the normal can be appreciated. As you say, the nature of the soil and the character of the plant has much to do with the development of the plant. That was taken for granted in giving to soil moisture a place in the equation, and in taking it for granted that the previous breeding of the plant used for establishing the relations in the equation had been known.

This equation is simply constructed to show the relation of meteorological data, and can be used, of course, with all life. I had originally intended to use the word "life" instead of the mere specific term "plant," but I decided upon the use of a plant as giving a more concrete form to the expression.

I hope you will see from this that these ideas of climatology are broad enough to include all life and human industries. The one formula, of course, will not stand, but the principal of equating the meteorological data should be applicable to the widest possible sphere. It is alike applicable to animal life and human industries as it is to plant life.

It seems to me that as yet we have very little "general climatology," and until the principles of this are well established and we know something of the relations of meteorological phenomena to life and industries, that it is hardly time to specialize, as Mr. Ward suggests, and have "agricultural climatology" and "anthropo-climatology," and what may come to be known as "industrial climatology." I think when Mr. Ward works out any units or relations between meteorological phenomena and man, that it can be connected with but little trouble with other forms of life and with human industries from what we already know of the relations between plant and animal life and human industries.

ERRONEOUS CONVERSION OF METRIC AND ENGLISH BAROMETER READINGS.

By Prof. C. F. MARVIN, Chief of Instrument Division.

The growing interchange of meteorological observations between the Weather Bureau and observers throughout the West Indies, Mexico, Central America, and elsewhere gives rise to many occasions in which readings of atmospheric pressure must be converted from French to English measures, or vice versa. We desire to caution observers and others against an error which is liable to be committed in this connection when dealing with uncorrected readings of mercurial barometers with brass or similar scales affected by temperature. For example, suppose the readings of the attached thermometer and scale of a mercurial barometer graduated in metric units are:

Attached thermometer	25.4° C.
Barometer reading	762.15 mm.

As it is desired to ascertain the corresponding air pressure in English units when the observer does not happen to have at hand a table giving corrections for temperature in metric units, he may now endeavor to use his table of corrections in English units instead, and will sometimes be inadvertently led into an error in making the conversion. That is to say, he will convert the temperature from Centigrade to Fahrenheit and the scale reading from millimeters to inches. In the present case this gives attached thermometer 77.7° and barometer reading 30.006. The temperature correction corresponding to 77.7° and 30 inches, as given by his table for English barometers, is —0.133, and he therefore concludes that the observed barometer reading in English units and corrected for temperature is 29.873. This process, however, leads to an erroneous result.

The correct conversion is found by taking the correction for temperature corresponding to 25.4° C. and 762 mm. from a table of corrections for temperature *in metric units*. In the present case the correction is —3.15 mm.; therefore, the corrected barometric reading is 759 mm., which converted into inches gives the true result, namely, 29.882 inches. The error thus pointed out results from two circumstances: First, that the metric and English scales of length are not standard at the same temperature; second, that all ordinary tables of barometric corrections for temperature include the effects of temperature on both the mercurial column and the brass scale. Scale readings of metric measures of length are standard at 0° C., that is, the freezing point, or 32° F.; whereas an English scale of inches is regarded as standard at 62° F. In both cases the height of the mercurial column is standard when the temperature is at the freezing point.

When, therefore, comparisons are being made between French and English barometers and all the readings are to be reduced to the same system of units, the observed readings must be separately corrected for temperature. This will require a table of corrections in metric measures for the French barometer and a separate table of corrections in English measures for the English barometer. The readings, after being thus corrected for temperature, are expressed in standard inches and millimeters, respectively, and may then be converted directly from one system to the other with correct results.

Generally the corrections for instrumental error and capillarity are so small that these may be applied either before or after correcting for temperature and the conversion of scale without appreciable affect on the result. If the corrections for instrumental error and capillarity are large, however, they should, to be strictly correct, be applied, after correcting for temperature, but before conversion to another system of units. Notwithstanding this rule, the graduated scale of barometers with relatively small tubes is often "set down," in order to compensate for the capillary depression of the mercurial column and to eliminate other instrumental imperfections which reduce the height of the column, such as an imperfect vacuum, for example. This setting of the graduated scale is an instrumental method of applying the correction for capillarity, etc.; but by applying it before and not after the correction for temperature it complicates the problem of attaining accuracy. However, any error thus introduced will ordinarily not exceed 0.001 of an inch, unless the depression of the scale is greater than about 0.2 of an inch.

We may remark, in this connection, that circumstances sometimes arise in which a Centigrade thermometer may be used to determine the temperature of an English barometer,

or a Fahrenheit attached thermometer may be used with a metric scale. In all such cases the temperature must be brought into the same system of units as the observed scale reading before corrections can be applied, and the observed reading must then be corrected for temperature before any conversion of the scale units can be made.

It need hardly be said that the foregoing remarks do not apply to readings of aneroid barometers whose corrections for temperature and instrumental error can not be definitely tabulated, each instrument requiring a specific table peculiar to that one instrument. These corrections are too generally quite ignored and not applied.

The proper course, in case barometric readings must be converted from one system of units to another, is to apply all known corrections expressed in the same system of units as that in which the observed scale reading is taken and then convert the corrected reading.

WEST INDIAN SERVICE.

By Prof. E. B. GARRIOTT, in Charge (dated August 3, 1898).

By virtue of an Act of Congress, approved July 7, 1898, the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, was authorized, through proper diplomatic channels—

To establish and equip meteorological observation stations of the same general character as the stations of the Weather Bureau now maintained in the United States, at such points in the West Indies and on the coast of the mainland, bordering the Caribbean Sea, and on the islands adjacent thereto, as might be needed.

The purpose of the establishment and equipment of observation stations in the regions named was—

To have daily observations on meteorological phenomena taken at the several stations, to collect reports thereof, by cable and otherwise, and to disseminate information based thereon of the approach of tropical hurricanes or other storms to the West Indies, and to the coasts of the United States, and to collect and publish such further climatological data as might be of public benefit.

With the approval of this Act operations were actively begun to establish stations of observation and report. Communications requesting permission to do this were addressed through the proper official channels to the several European governments having jurisdiction in the West Indies, observers, skilled and trained in the work of the Bureau were selected, and the necessary instrumental equipment for stations was prepared for transportation to selected points. Observers reported their arrival at Willemstad, Curaçoa, July 21; at Santiago, Cuba, Kingston, Jamaica, Port of Spain, Trinidad, July 29; at Santo Domingo, Santo Domingo, and St. Thomas, August 5; at Barranquilla, Colombia, South America, August 11; at Bridgetown, Barbados, August 12; at St. Christopher (St. Kitts), August 18, and at Colon, Colombia, South America, August 29.

Observations were regularly begun at five of these, i. e., Kingston, Santo Domingo, St. Thomas, Port of Spain, and Willemstad, August 9, at Santiago, August 11, and at Bridgetown, Barbados, August 31. Similar reports have been received daily for a long time from Habana, Cuba; Nassau, Bahamas; and Hamilton, Bermuda.

The central station is located at Kingston, Jamaica, and all other stations of the system cable daily, to Washington and Kingston, reports of observations taken at 6 a. m. and 6 p. m., seventy-fifth meridian time. In the presenceof unusual weather conditions, or in the event of observed premonitions of approaching hurricanes, special observations are telegraphed. In addition, and supplementary to the above-named West Indian stations, daily morning and evening reports are telegraphed (beginning August 9) to Washington via Galveston, Tex., from Tampico, Vera Cruz, and Coatzacoalcos; these stations on the Gulf of Mexico are manned and observations contributed by the officials of the Mexican Telegraph Company. Daily reports are also received (beginning August 17) by telegraph from a local observer at Merida, Yucatan.

The present plan of hurricane warnings provides that upon the receipt by the Weather Bureau at Washington of telegraphic information of the development of a hurricane in the West Indian regions, warning of the location, character, and probable movement and strength of the storm be furnished at any hour of the day or night to the Chief of Bureau of Navigation, Navy Department, who has provided for a prompt transmittal of the information to our fleets in West Indian and southern waters. Similar advices will be cabled directly to West Indian and southern coast ports in the threatened district and every available means will be employed in the interest of the naval and merchant marine to give the most effective distribution to the warnings.

The service above outlined is at present an emergency service, which has been hastily organized to meet a demand on the part of naval and commercial interests for warnings of destructive storms in the Gulf, Caribbean Sea, and the West Indian Islands. It is not organized for local climatic studies, but it is confidently expected that through the cooperation of representatives of European governments having possessions in the West Indies, and of the countries bordering on the Caribbean Sea and the Gulf of Mexico on the south and west, a system of weather reporting stations can be permanently established, which will not only permit the forecasting of hurricanes and northers but allow of such a determination of the climatic conditions as will be a most important factor in developing the wonderfully rich agricultural resources of the West Indian Islands.

THE JAMAICA WEATHER SERVICE.[1]

By Mr. MAXWELL HALL, Government Meteorologist (dated August 15, 1898).

This Service was established in 1880 in order to have the usual instruments read and recorded at Kingston, the chief town in Jamaica, to encourage the registration of the rainfall throughout the Island, and to give warning of approaching hurricanes.

Mr. Robert Johnstone, F. R. Met. S., has assisted me from the first; he undertook the registration of the instruments in Kingston, and thereby allowed me to return to my private residence, the Kempshot Observatory, near Montego Bay. These places are 78 miles apart on the line of usual approach of cyclones along the Caribbean Sea. Consequently, by an exchange of telegrams Mr. Johnstone and I have been able to make out fairly well what any cyclone was doing, and to issue the proper telegraphic notice or warning.

At times, during the absence of Mr. Johnstone, I have been assisted by Mr. J. F. Brennan, who has shown unusual skill in improving self-registering instruments.

The registration of the rainfall has been encouraged by issuing a monthly weather report to all the contributors, of whom there are about 200; among these weather reports there are published any special reports or investigations.

With regard to storm warnings, according to a revised list, 38 depressions have passed within barometric range of Jamaica since the service was established, but many were so clearly

[1] The article here communicated in response to a request by the Editor was originally prepared by Mr. Maxwell Hall as a response to a request from the Royal Meteorological Society, and may possibly be published in abstract in connection with the annual address of its President, Hon. F. C. Bayard. With regard to the General West Indian Service, partially organized at one time by Mr. Hall, a full account will be found in his introduction to Volume I of the Jamaica Meteorological Observations. We are pleased to learn that the recent effort of the Weather Bureau to organize a West Indian system meets with Mr. Hall's heartiest approval. In fact there is every assurance of friendly cooperation on the part of all the meteorological organizations now existing in the West Indian region.—ED.

due to cyclones at a distance which were not coming our way that we can not claim to have seriously dealt with more than twenty or so. At any rate no mistake has yet been made; the hurricane signals have been ordered up only thrice, August 18, 1880, August 20, 1886, and September 15, 1889.

Forecasts for daily rainfall were fairly successful, but could not reach those interested.

Forecasts for monthly rainfall were commenced in 1884 and discontinued in 1886; of these 80 per cent were correct, but the subject required more attention than I could give it, and when a large rainfall was forecast for May, 1886, which month proved unusually dry, and when with an average forecast for June, 1886, heavy rains fell June 5, and 6, and floods did great damage, it was clearly time to stop this mode of forecasting.

The following are the investigations which have been undertaken:

Barometer, diurnal variation of.—For every hour for each month of the year. (Weather report No. 192.)

Barometric pressures, mean (W. R. 192, and errata Vol. II).—Very special photographic arrangements were made by Mr. J. F. Brennan, who took and reduced the observations. With regard to the mean, it was found that the mean of the three readings at 7 a. m., 3 p. m., and 11 p. m. exactly agreed with the mean of the readings taken every hour.

Clouds, classification of (W. R. 193).—The classification is essentially the same as that adopted by the International Committee, but strato-cirrus was added; it is a cloud somewhat resembling cirro-stratus, but thick and woolly; it is a purely tropical cloud according to Mr. Abercomby.

Cyclones of 1880 (W. R. Vol. I, introduction).—An investigation of the two cyclones which passed over Jamaica August 18, that year, including their reciprocal movements.

Cyclones, generally, as observed in Jamaica (W. R. 96).

Cyclones, tropical (Nature, vol. 46, p. 393).—If a cyclone is approaching any place the time of arrival is the fall of the barometer below the mean divided by twice the rate of fall, and consequently it is possible to ascertain whether the cyclone is directly approaching or not, by the constancy in the time of arrival, as shown by observations made every two or four hours. This rule is most useful for isolated places.

Earthquakes (W. R. 77).—The cause of the oppressive weather before an earthquake is due to the stopping or diminution of the wind as shown by self-registering instruments. The barometer is also affected, and there is a tendency for stratus to form over the sky. There are not enough earthquakes in Jamaica to complete the investigation, but the recording instruments are kept constantly in perfect working order.

Health of Kingston (W. R. 123).—The connection between the meteorological results and the health of the chief town in Jamaica is interesting in many ways. In Jamaica the people suffer from *cold*, not from heat. There are nearly twice as many deaths in March after the cooler weather in January and February as there are in September after the hotter weather in July and August, and this is accentuated with respect to infantile mortality; for infants the ratio is *thrice* instead of twice.

Lightning, protection of buildings from (W. R. 136).—Confirming the report of the British Lightning Rod Conference, 1882.

Magnetic variation (W. R. 182).—Between the years 1700 and 1820 the variation of the compass was practically steady. Of late years it has been rapidly changing; the results of the investigation are given in a practical form.

Rainfall maps (published by the Jamaica Institute).—The colored maps are based upon observations made at about 153 stations for about twenty years, and they show the average distribution over the island for each month.

Rainfall and sun-spot period (Nature, vol. 49, p. 399).—The table given in Nature takes in Barbados, Antigua, and Trinidad, as well as Jamaica. It does not seem to be of much use for forecasting purposes. In 1893 I gave out that that year and the next few years would probably be drier than usual—the sun-spot maximum was then approaching, and 1891 had been unusually wet—but 1893 proved to be still wetter, and it was not until two or three years after the maximum in 1893 that drought was severely felt in certain parts of the Island, and the connection preserved.

Results, meteorological (W. R. 123).—These are for the most part means for ten years, 1880–89, with notes.

Temperature and pressure (Nature, vol. 35, p. 437, and vol. 36, p. 197).—The decrease of minimum temperature as we ascend in the air follows a law which is useful in many ways, and if we define the temperature of space to be that shown by a thermometer at a great distance from the earth and shaded by the earth from the sun, we find its temperature to be −311° F.

Tides in Kingston Harbor (W. R. 227).—When the moon's declination is small there are two very small tides in the twenty-four hours; when the moon's declination exceeds 9° north or south there is only one small tide in the twenty-four hours. This investigation is referred to here in consequence of the discovery of the variation of mean sea level with monthly temperature of the air. Let T be half the sum of the mean temperature of the air for any month and for the preceding month, then the

Mean sea level = constant + 0.84 inch $\times (T - 78.6°)$.

This seems to show that the variations of T are carried down as much as 500 feet below the ocean level.

Winds in Kingston (W. R. 200).—A careful investigation of the sea and land breezes by Mr. Brennan, as felt in Kingston.

The monthly form accompanying this article shows that the Jamaica Weather Service calls for the following data from its stations:

Latitude, longitude, height of barometer above mean sea level, height of rain gauge above mean sea level and above ground.

Barometric pressure at 7 a. m. and 3 p. m., reduced to standard temperature, the Kew standard barometer, standard gravity, mean sea level.

The air temperature (7 a. m., 3 p. m., max., min.) by corrected thermometers exposed on a lawn in a Stevenson screen.

The dew-point and relative humidity, 7 a. m. and 3 p. m. from the readings of the dry and wet bulb thermometers by Glaisher's Tables.

The rainfall at 7 a. m. daily, for the preceding twenty-four hours, as given by a rain gauge 8 inches in diameter.

The total daily movement of the wind at 7 a. m., as given by a small Robinson anemometer, in which the factor 3 is used.

The direction and velocity of the wind at 7 a. m. and 3 p. m., using the true meridian, and, if necessary, the estimated wind velocity, according to the Signal Service scale (light 1 to 2 miles per hour; gentle, 3 to 5; fresh, 6 to 14; brisk, 15 to 24; high, 25 to 39; gale, 40 to 59; storm, 60 to 79; hurricane, 80 and over).

Clouds, kind, amount, and direction of motion at 7 a. m. and 3 p. m., classified as lower, viz, fracto-stratus; middle, viz, cumulus; upper, viz, cirrus and cirro-stratus.

RAINFALL AT RIVAS, NICARAGUA.

By Dr. EARL FLINT.

Dr. Earl Flint, voluntary observer at Rivas, Nicaragua, has kindly furnished the accompanying table of monthly and

annual precipitation at that place, from January, 1880, to April, 1897, both inclusive. The station is located at N. 11° 26′, W. 85° 47′; elevation, 210 feet.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1880 ...	0.00	0.00	0.00	0.00	10.23	12.58	3.62	10.48	7.95	13.83	5.02	0.67	64.38
1881 ...	0.00	0.00	0.00	0.12	5.20	13.17	8.88	6.96	7.42	24.67	10.88	1.91	79.21
1882 ...	0.00	0.13	0.00	0.00	4.26	9.80	4.04	6.25	7.65	23.38	4.20	1.61	61.32
1883 ...	0.28	0.00	0.00	0.14	1.00	8.07	4.87	4.34	5.78	18.25	5.70	1.34	49.77
1884 ...	0.59	0.09	0.00	2.03	2.80	10.43	4.98	3.84	4.48	15.83	7.43	2.24	54.74
1885 ...	0.04	0.00	0.00	0.00	1.78	7.27	4.81	2.76	5.40	7.88	4.36	0.29	34.59
1886 ...	0.23	0.20	0.00	0.17	13.00	7.87	15.00	20.80	15.30	10.40	3.75	0.49	87.21
1887 ...	0.90	0.81	0.00	0.00	9.17	8.18	4.10	5.03	19.42	22.47	2.50	2.31	74.89
1888 ...	1.83	0.04	0.00	0.00	7.12	8.50	4.18	5.00	9.80	16.80	1.11	1.13	55.51
1889 ...	0.00	0.19	0.07	1.71	11.34	11.64	7.48	12.95	9.80	24.13	3.38	1.67	84.36
1890 ...	0.49	0.11	0.94	0.00	2.63	4.56	4.73	3.78	2.77	9.68	1.30	0.82	31.81
1891 ...	0.00	0.00	0.00	0.78	0.75	24.58	4.38	4.21	12.42	14.90	2.34	1.67	66.03
1892 ...	0.19	0.00	0.00	0.00	13.30	9.80	9.19	7.48	12.22	21.26	4.40	0.43	78.27
1893 ...	0.06	0.39	0.00	0.11	20.03	21.14	13.22	18.70	14.00	13.56	1.44	2.48	105.13
1894 ...	2.12	2.36	0.08	0.00	7.76	6.32	3.64	4.57	4.33	14.62	3.21	0.43	49.44
1895 ...	0.00	0.08	0.19	0.39	8.11	1.10	5.25	3.42	8.01	8.97	2.04	0.20	50.56
1896 ...	0.40	0.08	0.00	T.	3.26	6.23	7.43	6.57	7.40	7.42	8.62	0.39	47.80
1897 ...	0.33	T.	1.04	0.00	21.30	24.34	6.41	12.10	17.63	33.85	5.15	1.28	123.43
1898 ...	1.07	0.12	0.10	0.00	16.17	18.95	13.65	.....	.....	.....	...	.....	.....
Means.	0.45	0.24	0.30	0.29	8.38	11.20	6.83	7.94	9.54	17.38	4.27	1.19	67.56

RAINFALL IN NICARAGUA.

By A. J. HENRY, Chief of Division.

As supplementary to the record of rainfall by Mr. William Cline at Masaya and Granada, in Nicaragua, published on page 162 of the MONTHLY WEATHER REVIEW for April, 1898, and the table by Dr. Earl Flint at Rivas, Nicaragua, on page 305 of the current number of the REVIEW for July, the following statistics given for other places have been collected from the respective publications, and are reprinted for convenience of reference:

(1) GRANADA.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1876 ...	.....	.....	.....	.....	5.77	13.65	26.61	4.96	.....	.....	.....	.....	.....
1877 ...	0.00	0.00	0.00	0.00	11.57	10.24	10.12	5.32	17.36	5.27	0.87	0.59	61.34

(2) GRANADA.

1883 ...	0.35	0.00	0.00	0.18	0.28	5.20	2.66	5.47	9.74	19.91	3.64	0.00	47.43
1884 ...	0.00	0.00	0.00	0.00	0.00	8.25	3.99	3.75	8.82	8.63	2.28	0.26	35.98

(3) BLUEFIELDS.

1883 ...	.....	.....	.....	....	.....	.....	.....	.....	3.42	8.13	12.13	17.00	.....
1884 ...	10.25	6.39	3.21	2.06	2.67	8.01	17.06	16.40	5.82	4.99	9.71	11.15	97.72
1885 ...	1.96	1.60	2.66	2.87	5.89	13.37	19.82	11.75	8.07	2.69	7.70	3.15	81.53
1886 ...	7.28	*3.94	1.63	.....	.....	.....	... ...	8.55	.....	.....	.....	.....	.....

* For twenty-four days only.

(4) GREYTOWN.

1890 ...	26.80	6.36	5.93	18.11	4.93	46.84	52.55	35.72	8.14	24.36	25.55	41.65	296.94
1891 ...	20.30	2.57	1.95	10.40	13.78	26.95	23.57	19.49	14.16	20.21	28.15	32.74	214.27
1892 ...	28.57	11.38	4.98	18.38	50.88	13.42	38.96	23.63	11.47	27.95	36.93	24.65	291.20
1893 ...	17.70	7.53	3.93	9.99	2.77	.....	.....	.....	.....	.....	.....	.....	.....

(1) *Granada.*—Observations made in 1876 by Ramon Espinola; in 1877 by Earl Flint; from unpublished manuscripts in Weather Bureau. Location, N. 11° 56′; W. 85° 54′; elevation, 218 feet.

(2) *Granada.*—Observations made at the National Institute. Location, N. 11° 56′; W. 85° 54′; elevation, 230 feet. Reported in Senate Ex. Doc. No. 99, Forty-ninth Congress, first session.

(3) *Bluefields.*—Observations by Hon. W. H. Jackson and others. Published in the International Bulletin of the Signal Service. Location, N. 12° 00′; W. 83° 43′; elevation, — feet.

(4) *Greytown.*—Observations made under the direction of Dr. J. E. Stubbert, of the Nicaragua Canal Company. Location, N. 10° 59′; W. 83° 42′; elevation, — feet. Reported in Senate Ex. Doc. No. 74, Fifty-third Congress, second session, pp. 54–55.

According to the report of the United States Nicaragua surveying party for 1895, by A. G. Menocal, Civil Engineer, U. S. N. (Forty-ninth Congress, first session, Senate Ex. Doc. No. 99, p. 36), Col. O. W. Childs, an American engineer, made the first careful survey for a canal by this route in 1850–51. His meteorological records were taken at Rivas from September 7, 1850 to March 11, 1851, and in the valley of the San Juan River, from the latter date to September 25, 1851.

Commander E. P. Lull, U. S. N., in charge of the United States Survey expedition of 1872–73 (see ——— Congress, —— session ——), obtained a meteorological record from July 1, 1872 to March 14, 1873, at Virgin Bay, 4 miles south of Rivas.

The National Institute of Granada established a well conducted system of meteorological observations in 1880 at Granada (N. 11° 56′, W. 85° 51′; elevation, 229.6 feet). The monthly means for 1883 and 1884 are given by Menocal in his report of 1885, in lieu of any special observations by his own survey party, which left Washington December 17, 1884, beginning operations in Nicaragua on January 22, and leaving that country May 12, 1885. This record as published by him is as follows (the thousandths have been omitted from the rainfall):

RAINFALL.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1883 ...	0.35	0.00	0.00	0.20	0.28	5.20	2.66	5.47	9.74	19.91	3.64	0.00	47.44
1884 ...	0.00	0.00	0.00	0.00	0.00	8.25	3.99	3.75	8.82	8.63	2.28	0.26	35.98

NUMBER OF RAINY DAYS.

1884 ...	0	0	0	0	0	10	12	9	16	17	8	2	74

WIND.

1883 ...	NE.	E.	E.	E.	E.	E.	SE.	E.	E.	NE.	NE.	N.	E.
1884 ...	SE.	E.	SE.	NE.	NE.	E.	E.	E.	E.	SW.	SE.	NE.	E.

MAXIMUM TEMPERATURE.

1883 ...	88.5	88.0	89.0	91.0	93.0	91.0	89.5	89.5	89.5	88.0	88.0	88.0	89.4
1884 ...	86.0	87.0	89.0	91.5	91.5	91.5	90.5	90.5	89.5	89.5	89.5	87.0	89.4

MINIMUM TEMPERATURE.

1883 ...	70.0	69.0	71.5	75.0	73.5	78.0	71.5	68.0	71.5	70.0	68.0	66.0	71.0
1884 ...	70.0	66.0	65.0	71.5	73.5	70.0	71.0	68.0	68.0	68.0	69.0	68.0	69.0

MEAN TEMPERATURE.

1883 ...	81.0	82.0	82.5	83.0	84.0	82.5	81.5	81.0	80.0	79.0	77.5	75.0	80.8
1884 ...	80.0	80.0	81.0	82.0	81.0	80.5	81.0	83.5	82.5	79.0	82.0	80.0	81.0

MEAN BAROMETER.

1883 ...	29.70	.66	.74	.70	.66	.63	.63	.68	.60	.68	.67	.67	29.67
1884 ...	29.65	.64	.60	.64	.64	.61	.61	.58	.56	.62	.64	.65	29.62

RAINFALL OF MASAYA AND GRANADA, NICARAGUA.[1]

By A. J. HENRY, Chief of Division.

Dr. Earl Flint, for many years voluntary observer of the Smithsonian Institution and the Signal Service, and the present correspondent of the Weather Bureau for Rivas, Nicaragua, furnishes the following table of rainfall, as observed by Mr. Cline.

Masaya is in latitude 12° 2′ N., longitude 86° W.; Granada is in latitude 12° N., longitude 85° 56′ W. Observations were made by Mr. William Cline, civil engineer, at Masaya,

[1] Reprinted from the April Review.

from 1886 to 1896, and at Granada for the remainder of the time. Nothing is known of the kind of gauge used or its exposure, but from the professional standing of the observer and the general agreement between the recorded amounts and those obtained by Dr. Flint at Rivas (latitude 11° 26′ N., longitude 85° 47′ W., elevation, 200 feet above sea level), it is concluded that the series is reliable.

The rainy season at Masaya, as elsewhere in Nicaragua, begins in May and ends in the latter part of October. December, January, February, and March are almost destitute of rain, less than 2 per cent of the annual fall occurring in those months.

The greatest fall in any year was at Granada, in 1897 93.62 inches, or 162 per cent of the mean fall; the least fall of any year was at Masaya, in 1890, 20.52 inches, but 35 per cent of the mean fall. Such a disproportion between the amount of rain in the year of minimum rainfall and the mean is rarely observed. The variation in the fall of the same month in different years is even greater. The short dry season in the middle of summer, which is a characteristic of the rainfall of portions of Central America, is not well marked at Masaya; in some years heavy rain is continuous from May to November.

Monthly and annual amounts of rainfall at Masaya, 1886–1896, and Granada, 1897, Nicaragua, in inches and hundredths.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1886	.....	.....	.....	*	.....	.....	8.23	15.26	15.34	11.19	0.69	0.02	*72.70
1887	0.30	0.00	0.00	0.00	2.42	10.73	7.39	5.74	9.15	23.56	0.94	0.99	61.22
1888	0.05	0.14	0.00	0.00	7.09	12.09	4.95	9.50	17.21	7.67	0.00	0.00	58.70
1889	0.00	0.00	2.39	1.18	6.43	17.00	7.87	13.43	14.53	13.36	2.34	0.25	78.78
1890	0.14	0.00	0.00	0.60	1.82	3.00	2.86	2.66	2.95	5.89	0.42	0.18	20.52
1891	0.19	0.00	0.00	1.02	0.48	20.94	4.52	4.20	10.40	5.45	2.78	0.00	49.98
1892	0.00	0.00	0.00	0.00	7.36	14.42	8.70	6.75	9.64	15.71	1.66	0.30	64.54
1893	0.00	1.15	0.00	0.00	9.26	11.78	11.47	15.82	12.67	6.51	2.70	1.50	72.86
1894	0.32	0.50	0.00	0.00	7.87	4.77	3.32	4.00	7.49	13.42	1.08	0.11	42.88
1895	0.00	0.00	0.00	0.41	4.57	4.71	5.22	2.90	8.36	14.46	0.57	0.06	41.26
1896	0.33	0.00	0.00	0.09	5.62	7.90	7.13	2.98	6.62	4.22	4.85	0.00	39.64
1897	0.00	0.00	0.97	1.77	16.63	30.79	8.88	10.87	10.21	11.97	1.25	0.28	93.62
Means	0.11	0.16	0.31	0.46	6.32	12.56	6.71	7.84	10.38	11.12	1.61	0.31	57.89

*The estimated rainfall January to June, 1886, inclusive, was 21.97.

THE CHARACTER OF THE EVENING.

By P. CONNOR, Local Forecast Official (dated Kansas City, Mo., August 16, 1898).

Referring to the remarks of Mr. Lee A. Denison, observer, Weather Bureau, on page 215 of MONTHLY WEATHER REVIEW for May, 1898, and commended by the Editor, in regard to stations keeping a record to show the "Character of the Evening" (to include the hours from twilight to midnight) for use in court, I beg permission to state that, according to my experience with lawyers and as a witness producing the Weather Bureau records in court, such a record as that suggested would be thrown out as "incompetent testimony," unless the cause of the litigation involved the entire period mentioned, that is, from twilight to midnight, which it rarely does. The act, whatever it may have been, is as a rule, located "at or about" a certain time. The records will show an average condition for a much longer period, but nothing definite at the time of occurrence. The lawyer on the opposing side will make the person having the records in court confess that he does not know, and that the records do not show whether or not it was light or dark at a certain time; that it could have been *either at the time* in question and yet make the average shown by the records. Anybody who has had much court experience knows that such testimony would be thrown out. Kansas City records had been called into court 31 times during the year ending June 30 last, so that we have some idea of the exactions of lawyers and the rulings of judges.

METEOROLOGY AT JOHNS HOPKINS UNIVERSITY.

By O. L. FASSIG, Observer, Weather Bureau (dated July 26, 1898).

In 1897 the University authorities, through the efforts of Prof. Wm. B. Clark, provided for regular and permanent instruction in climatology in connection with the course for graduate students in the Department of Geology. Instruction in this branch is now required of all candidates for the doctor's degree taking geology as a major study.

The first instruction in the course was given by me in the fall of 1898, and consisted of a series of twelve lectures. A list of the lectures as delivered is submitted herewith. The purpose of this series was to present to the students, as clearly as was possible for me within the narrow limits prescribed, the principles underlying the science of climatology, and the practical results achieved by the study of statistical climatology. Two lectures per week were given during October and November. The class comprised fifteen students, an unusually large number for a class composed entirely of advanced students. As many of these students are preparing themselves for the profession of teaching in the higher schools and universities of the land it is especially desirable to reach this class in order to promote an interest in favor of meteorology in our educational institutions.

During the month of May the instruction by lectures was supplemented by a practical course for two weeks in the use of meteorological instruments. To the usual course of instruction in the lecture room and in the laboratory, Professor Clark this year added a practical course in field work for his advanced students in geology. The work of the University was transferred to the field. For a period of two weeks the students were encamped in the Allegheny Mountains near Cumberland, Md., and under the guidance of specialists, devoted themselves to the study of nature at first hand. Through the courtesy of the Chief of the Weather Bureau the camp was provided with a complete outfit of meteorological instruments, and the undersigned was granted official time for the duties of instructor in camp. The students were put through the daily routine of an observer, and informal talks were given about meteorological instruments and about weather forecasting. Nearly all of the students in camp availed themselves of the opportunity thus offered to become familiar with the instruments and their method of exposure.

The course of instruction planned for the coming college year is along the same lines as that of the past year, but the lectures are increased in number from twelve to twenty, thus giving me an opportunity to go more into detail and to draw more largely from the rich statistical material of the United States Weather Bureau.

In this connection permit me to mention that much time and labor have been spent in preparing the notes of this lecture course, so that they might readily be utilized in giving a similar course at one or more of the large universities, should such a policy be deemed advisable in order to promote in University circles a more general interest in meteorology and climatology.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for July, 1898.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Min.	Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Durango (Seminario)	6,243	24.07	82.4	51.8	68.5	51	5.77	... .	e
Leon (Guanajuato)..	5,934	24.32	84.4	55.4	67.1	66	9.41	ese.	e., ne.
Linares (New Leon)..	1,188	28.69	102.2	69.8	84.2	63	0.08	se.	se.
Magdalena (Sonora).	2,618	.....	95.9	72.0	86.0	.....	7.72	s.	n., ne.
Mexico (Obs. Cent.)..	7,472	23.09	76.5	52.5	61.5	68	4.88	nw.	ne.
Morelia (Seminario)..	6,401	23.99	78.8	52.2	64.2	74	6.75	ssw.,sw.	e.
Oaxaca	5,164	25.09	88.0	53.1	69.6	72	4.44	nw.	e.
Saltillo	5,399	24.89	92.3	59.0	74.7	77	3.70	sw.	n.
Tuxpan (Vera Cruz).	.....	30.19	96.8	70.2	82.4	79	2.93	e.	n., w.
Zacatecas	8,015	22.53	77.0	48.2	60.4	59	5.74	e.	e.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, a copy of the daily record at Honolulu is communicated to the Weather Bureau in advance of its official publication, and is herewith printed, as a special contribution, for the convenience of those who are studying the relations of the storms and weather of the United States to those of adjacent countries, with a view to long-range, seasonal predictions.

Meteorological observations at Honolulu.

JULY, 1898.

July, 1898.	Pressure at sea level. 7 a. m.	3 p. m.	9 p. m.	Temperature. 6 a. m.	2 p. m.	9 p. m.	Maximum.	Minimum.	Relative humidity. 7 a. m.	2 p. m.	9 p. m.	Wind. Direction.	Force.	Cloudiness.	Rain measured at 6 a. m.
1.	30.02	29.98	30.04	68	82	76	83	66	74	62	74	nne.	2-0	2	0.07
2.	30.05	30.04	30.08	74	84	78	85	69	67	64	75	e-ne.	3	3-8	0.00
3.	30.10	30.05	30.12	75	80	75	81	75	67	63	78	ene-nne.	4	8	0.00
4.	30.10	30.04	30.09	75	76	74	80	71	74	78	80	ne.	2	6	0.04
5.	30.06	29.99	30.04	72	81	74	81	70	82	58	70	ene-n.	3-0	6-2	0.11
6.	30.04	30.02	30.07	67	82	76	83	66	74	53	70	ne.	3	3	0.02
7.	30.08	30.04	30.09	73	82	75	83	71	70	58	74	ene-ne.	3	2-5	0.03
8.	30.09	30.06	30.09	72	81	74	82	71	74	61	78	ne.	2-4	6-3	0.12
9.	30.09	30.03	30.08	73	82	76	82	70	70	62	70	ne.	3-1	4-2	0.16
10.	30.08	30.03	30.08	72	81	76	82	71	80	61	68	nne.	2-4	5	0.04
11.	30.08	30.01	30.06	73	79	74	82	71	70	68	74	nne.	3-4	5-7	0.03
12.	30.08	30.04	30.11	73	81	76	81	72	82	61	70	ne.	3	5	0.04
13.	30.11	30.07	30.10	74	80	76	81	72	74	64	70	ene.	5	5	0.19
14.	30.10	30.05	30.10	74	75	77	79	72	81	82	63	nne.	5	6	0.10
15.	30.07	30.01	30.03	75	80	75	81	74	70	57	70	nne.	5-3	4	0.03
16.	30.02	29.96	30.00	74	80	76	83	72	72	64	74	ne.	3	3	0.02
17.	30.03	29.98	30.03	74	80	77	81	73	82	68	72	ene.	4-5	4	0.08
18.	30.04	29.99	30.05	74	81	74	82	74	70	58	78	ne.	4-3	3	0.03
19.	30.04	29.98	30.04	72	82	75	83	69	82	58	76	ne.	3	2-6	0.11
20.	30.03	29.98	30.02	72	81	77	83	71	82	61	71	ne.	3	5	0.05
21.	30.04	29.99	30.04	72	84	76	85	71	77	61	80	ene-ne.	3	3	0.00
22.	30.02	29.99	30.04	76	79	76	82	73	74	70	70	ene.	3-4	3-8	0.04
23.	30.05	30.02	30.06	75	78	76	83	74	74	73	76	ne.	5	3	0.02
24.	30.07	30.02	30.04	75	81	75	82	73	78	61	74	ne.	5-6	2	0.09
25.	30.08	30.03	30.07	75	81	76	83	73	70	60	70	nne.	3-5	3	0.01
26.	30.07	30.01	30.03	75	81	76	82	74	70	60	68	ene.	4-5	3-5	0.00
27.	30.02	29.97	30.04	74	82	76	82	71	74	56	70	nne.	4	3	0.13
28.	30.04	29.99	30.06	75	80	77	83	73	70	61	68	ne.	4	4	0.00
29.	30.04	29.97	30.04	76	81	75	83	75	70	60	82	ne.	3-0	{8-5 / 10}	0.00
30.	30.04	29.97	30.04	74	81	78	83	72	82	67	73	ne.	1-4	5-10	0.06
31.	30.03	30.00	30.07	76	82	78	83	74	76	65	73	ne.	3-4	{10-6 / 10}	0.01
	30.06	30.01	30.06	73.5	80.6	75.8	82.2	71.7	72.6	63.0	72.9	.....	3-4	4.8	1.63

The station is at 21° 18′ N., 157° 50′ W.; altitude 50 feet.

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, −0.06, is still to be applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10. Two directions of wind, or values of wind force, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 8 feet above ground. Ground is 50 feet above sea level.

Monthly mean temperature (6 + 2 + 9) ÷ 3 is 76.6, and the normal mean is ——. The normal rainfall for July is ——.

OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26′ N., 85° 47′ W. The observations at 7:17 a. m., local time are simultaneous with Greenwich 1 p. m. The altitude of his barometer is 36 meters above sea level, but until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0–12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

His station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of his station. Mr. Flint's records occasionally mention the presence of clouds in the early morning on the summit of this mountain.

Observations at Rivas, Nicaragua, June, 1898.

OBSERVATIONS AT 7 A. M. LOCAL (8 A. M. EASTERN STANDARD) TIME.

Date.	Temperature. Air.	Dew-point.	Wind. Direction.	Force.	Upper clouds. Kind.	Amount.	Direction from.	Lower clouds. Kind.	Amount.	Direction from.	Daily rainfall.
	°	°									
1	78	74	ne.	0	c.	1	sw.	ks.	1	ne.	0.00
2	75	73	nw.	0	cs.	3	sw.	.....	.....	.....	0.00
3	79	72	se.	0	cs.	1	se.	ks.	1	se.	0.00
4	78.5	72	se.	1	cs.	5	.....	ks.	1	se.	0.00
5	79	75	ne.	0	ck.	1	ne.	.....	.....	.....	0.00
6	80	74	ne.	0	.....	.....	.....	ks.	10	ne.	0.00
7	78	74	ne.	0	.....	.....	.....	ks.	10	ne.	0.04
8	81	76	se.	0	.....	.....	.....	ks.	10	se.	0.13
9	81	76	se.	0	c².	10	se.	.....	.....	.....	0.15
10	80	76	se.	0	.....	.....	.....	ks.	10	se.	0.40
11	82	77	ne.	1	c.	Few	ne.	.....	.....	.....	0.00
12	79	74	se.	0	.....	.....	.....	ks.	5	se.	0.00
13	80	74	ne.	0	.....	.....	.....	ks.	10	ne.	0.16
14	79	72	se.	2	ck.	8	se.	ks.	8	se.	0.00
15	78	72	se.	1	ck.	10	sw.	.....	.....	.....	0.08
16	79.5	72	se.	1	cs; ck.	7	se.	.....	.....	.....	0.00
17	75.5	73	sw.	1	.....	.....	.....	n.	10	sw.	1.16
18	77	74	sw.	0	.....	.....	.....	ks.	10	se.	3.98
19	76	74	se.	0	ck.	10	se.	.....	.....	.....	1.26
20	77	73	se.	0	ck.	5	se.	.....	.....	.....	1.67
21	76	73	sw.	0	ck.	10	sw.	.....	.....	.....	0.00
22	74	72	sw.	0	ck.	10	sw.	.....	.....	.....	3.22
23	74	72	sw.	0	ck.	10	sw.	.....	.....	.....	0.40
24	75	74	s.	0	ck.	10	s.	.....	.....	.....	0.40
25	77	73	sw.	0	ck.	10	sw.	.....	.....	.....	0.30
26	76	74	se.	0	cs.	10	se.	.....	.....	.....	0.00
27	75.5	73	sw.	0	.....	.....	.....	n.	10	sw.	4.72
28	77	74	sw.	0	.....	.....	.....	n.	10	sw.	1.18
29	75	73	sw.	0	.....	.....	.....	ks.	10	.....	0.00
30	77	73	nw.	0	cs.	10	.....	ks.	10	.....	0.00
Means	77.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	18.95

OBSERVATIONS AT 8 P. M. LOCAL (9 P. M. EASTERN STANDARD) TIME.

Date.	Temperature. Air.	Dew-point.	Wind. Direction.	Force.	Upper clouds. Kind.	Amount.	Direction from.	Lower clouds. Kind.	Amount.	Direction from.
	°	°								
1	79	73	se.	0	c.	3	se.	.....	.....	.....
2	79	75	se.	0	c.	2	se.	ks.	2	se.
3	82	74	se.	1	c.	5	se.	.....	.....	.....
4	81	76	se.	1	c.	3	se.	.....	.....	.....
5	84	77	e.	0	.....	.....	.....	ks.	8	e.
6	81	78	se.	0	.....	.....	.....	ks.	4	se.
7	82	77	se.	0	ck	2	se.	.....	.....	.....
8	80	77	se.	0	.....	.....	.....	ks.	10	se.
9	80	76	se.	1	.....	.....	.....	ks.	10	se.
10	81	78	n.	0	.....	.....	.....	ks.	10	n.
11	80	74	se.	0	.....	.....	.....	ks.	0	se.
12	80	76	se.	0	.....	.....	.....	ks¹	.....	se.
13	77	73	se.	2	ck¹.	.....	se.	.....	.....	.....
14	78	71	se.	2-3	ck.	10	se.	.....	.....	.....
15	79	72	se.	0	ck¹.	.....	se.	.....	.....	.....
16	81	78	se.	0	ck.	5	se.	.....	.....	.....
17	78	75	sw.	0	.....	.....	.....	ks.	10	sw.
18	78	78	sw.	0	.....	.....	.....	ks.	10	sw.
19	78	77	se.	0	.....	.....	.....	ks.	10	sw.
20	75	74	se.	0	.....	.....	.....	n.	10	se.
21	75	75	sw.	0	.....	.....	.....	n.	10	sw.
22	75	75	sw.	0	.....	.....	.....	n.	10	sw.
23	78	78	s.	0	.....	.....	.....	n.	10	sw.
24	76	73	s.	0	.....	.....	.....	n.	10	sw.
25	76	73	nw.	1	.....	.....	.....	n.	10	nw.
26	75	75	sw.	1	.....	.....	.....	n.	10	sw.
27	74	71	sw.	0	.....	.....	.....	n.	10	sw.
28	75	75	sw.	0	.....	.....	.....	n.	10	sw.
29	77	73	se.	0	.....	.....	.....	ks.	5	se.
30	77	73	se.	0	.....	.....	.....	n.	10	se.
Means	78.4	.....	.....	.....	.....	.....	.....	.....	.....	.....

Observations at Rivas, Nicaragua, July, 1898.

OBSERVATIONS AT 7 A. M. LOCAL (8 A. M. EASTERN STANDARD) TIME.

Date.	Temperature. Air.	Temperature. Dew-point.	Wind. Direction.	Wind. Force.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction from.	Lower clouds. Kind.	Lower clouds. Amount.	Lower clouds. Direction from.	Daily rainfall.
	°	°									
1	78	74	se.	0	.....	.....	.....	n.	10	se.	0.00
2	75	73	se.	1	.....	.....	.....	n.	10	se.	1.42
3	76	74	se.	0	.....	.....	.....	n.	10	se.	0.40
4	77	73	ne.	0	.....	.....	.....	ks.	10	se.	0.00
5	77	73	ne.	1	cs.	2	se.	.....	.....	.....	0.00
6	76	74	sw.	0	.....	.....	.....	ks.	5	sw.	0.00
7	77	73	sw.	0	.....	.....	.....	n.	10	sw.	1.97
8	75	74	se.	0	.....	.....	.....	ks.	10	se.	0.00
9	75	74	sw.	0	.....	.....	.....	ks.	5	sw.	0.78
10	75	74	sw.	0	.....	.....	.....	ks.	10	sw.	0.40
11	74	71	sw.	0	.....	.....	.....	ks.	10	sw.	0.00
12	76	74	s.	0	.....	.....	.....	ks.	10	s.	0.00
13	75.5	72	sw.	0	.....	.....	.....	ks.	10	s.	0.00
14	76	73	s.	0	ck.	5	ne.	.....	.....	.....	0.00
15	78	73	se.	0	.....	.....	.....	k.	9	se.	0.00
16	78	73	se.	0	.....	.....	.....	k.	8	se.	0.00
17	79.5	71	se.	0	.....	.....	.....	k.	10	se.	1.18
18	79	76	s.	1	.....	.....	.....	k.	9	s.	0.86
19	75	72	se.	2	.....	.....	.....	k.	10	se.	0.18
20	76	70	ne.	0	.....	.....	.....	k.	10	ne.	0.00
21	76	70	ne.	1	.....	.....	.....	n.	10	ne.	0.80
22	77	73	se.	0	.....	.....	.....	ks.	10	se.	0.00
23	76	73	ne.	1	.....	.....	.....	n.	10	se.	0.40
24	77	74	ne.	1	.....	.....	.....	n.	10	ne.	0.00
25	79	75	ne.	2	cs.	10	ne.	ck.	10	ne,	0.20
26	78	75	ne.	1	.....	.....	.....	ks.	10	ne.	0.00
27	77	70	ne.	1	.....	.....	.....	ks.	10	ne.	0.40
28	77	73	e.	1	.....	.....	.....	k.	9	e.	0.00
29	76	73	e.	2	ck.	10	e.	.....	.....	.....	0.00
30	76	73	se.	1	.....	.....	.....	n.	10	se.	*3.86
31	75	73	ne.	0	.....	.....	.....	ks.	10	ne.	0.00
Means	76.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.65

21st, light shock of earthquake, 11:55 p.
30th, excessive rain 3.86 inches in fifteen hours;* month, 13.65 inches, mean of eighteen years, 6.455.
*[As Mr. Flint's form credits this rainfall to the twenty-four hours preceding 7 a. m. of the 30th it is doubtful whether his reports adhere to the uniform rule of accrediting rainfall to the a. m. observation at the close of each daily period.—ED.]

OBSERVATIONS AT 8 P. M. LOCAL (9 P. M. EASTERN STANDARD) TIME.

Date.	Temperature. Air.	Temperature. Dew-point.	Wind. Direction.	Wind. Force.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction from.	Lower clouds. Kind.	Lower clouds. Amount.	Lower clouds. Direction from.
	°	°								
1	78	75	se.	0	.....	.....	.....	n.	10	se.
2	77	73	ne.	1	.....	.....	.....	n.	10	ne.
3	79	72	ne.	1	ck.	0	ne.	.....	.....	.....
4	76	73	ne.	1	ck.	5	ne.	.....	.....	.....
5	78	75	ne.	1	ck.	5	ne.	.....	.....	.....
6	80	76	sw.	0	ck.	10	sw.	.....	.....	.....
7	75	74	sw.	0	ck.	10	sw.	.....	.....	.....
8	78	74	sw.	0	ck.	10	sw.	.....	.....	.....
9	77	73	sw.	0	.....	.....	.....	ks.	10	sw.
10	76	73	s.	0	.....	.....	.....	ks.	10	s.
11	77	73	s.	0	.....	.....	.....	ks.	10	s.
12	76	73	se.	0	.....	.....	.....	ks.	10	se.
13	79	73	s.	0	.....	.....	.....	ks.	10	s.
14	80	76	se.	0	.....	.....	.....	k.	5	s.
15	80	76	se.	1	.....	.....	.....	k.	8	s.
16	80	76	se.	1	.....	.....	.....	k.	10	se.
17	78	74	se.	0	.....	.....	.....	ks.	10	se.
18	78	74	se.	1	.....	.....	.....	ks.	10	se.
19	78	74	se.	1	.....	.....	.....	ks.	10	se.
20	77	73	ne.	1	.....	.....	.....	ks.	10	ne.
21	77	73	se.	0	.....	.....	.....	k.	5	se.
22	77	74	ne.	0	.....	.....	.....	k.	10	se.
23	80	76	ne.	0	.....	.....	.....	k.	10	se.
24	80	76	ne.	0	.....	.....	.....	k.	Few	ne.
25	80	76	ne.	0	.....	.....	.....	ks.	5	ne.
26	76	73	ne.	1	.....	.....	.....	ks.	10	ne.
27	77	72	e.	1	.....	.....	.....	ks.	10	ne.
28	77	73	e.	1	ck.	7	e.	.....	.....	.....
29	79	73	se.	1	ck.	10	se.	.....	.....	.....
30	76	73	ne.	0	.....	.....	.....	ks.	5	ne.
31	78	74	se.	0	ck.	10	se.	.....	.....	.....
Means	78.2	.....	.....	.....	.....	.....	.....	.....	.....	.....

CLIMATOLOGICAL DATA FOR JAMAICA, W. I.

Through the kindness of Mr. Maxwell Hall, of Montego Bay, Jamaica, the meteorological service of that colony communicates an abstract of the very interesting climatological records of that highly important West Indian service. The climatological summary furnished by Mr. Hall, through his assistant, Mr. Robert Johnstone, of the Meteorological Office, is reproduced in the following table. For descriptive details of the stations and instruments see Vol. XXV, pages 308 and 356.

Montego Bay, where Mr. Maxwell Hall resides, is between 4 and 5 miles west, and also the same distance north of Kempshot Observatory. The location of the latter is N. 18° 24′ 50″, W. 77° 52′ 22″. Stony Hill Reformatory is about 8 miles north of Kingston and within a mile to the west. Hope Gardens is between 3 and 4 miles to the north of Kingston, and about the same distance to the east. From these measurements the latitudes and longitudes given in the following table have been deduced:

Climatological data for Jamaica, W. I.
JUNE, 1898.

	Morant Point Lighthouse.	Negril Point Lighthouse.	Kingston.	Montego Bay.	Castleton Gardens.	Hope Gardens.	Stony Hill Reformatory.	Hill Gardens. (Chn. Planet.)
Latitude	17°56′	18° 16′	17° 58′	18° 30′	18° 12′	18° 02′	18° 06′	18°05′
Longitude	76°10′	78° 23′	76° 48′	77° 57′	76° 50′	76° 46′	76° 49′	76°39′
Elevation (feet)	8	33	50	160	580	600	1,400	4,907
Mean barometer 7 a. m.	29.937	29.937	29.940	29.943	29.964	.....	.....	25.232
Mean barometer 3 p. m.	29.911	29.907	29.898	29.898	29.887	.....	.....	25.210
Mean temperature 7 a. m.	.....	78.6	77.4	75.7	71.7	74.0	73.0	62.1
Mean temperature 3 p. m.	.....	83.1	84.9	83.3	82.7	82.7	80.0	66.2
Mean of maxima	.....	86.8	87.8	86.6	88.1	87.0	85.8	70.0
Mean of minima	.....	73.2	73.1	70.7	67.0	68.0	67.5	58.5
Highest (absolute) maximum	.....	88.8	90.6	88.4	92	90	88	74
Lowest (absolute) minimum	.....	67.9	70.0	68.3	63	64	65	55
Mean dew-point 7 a. m.	.....	71.9	69.5	71.0	69.0	68.4	69.5	56.8
Mean dew-point 3 p. m.	.....	73.5	71.1	73.5	74.3	71.0	74.9	61.8
Mean relative humidity 7 a. m.	.....	80	77	86	88	81	89	81
Mean relative humidity 3 p. m.	.....	73	64	73	75	67	85	85
Monthly rainfall (inches)	4.05	6.07	3.39	5.57	6.52	5.07	5.07	8.73
Average daily wind movement	.....	225.5	61.1	53.9	.....	.....	.....	41.5
Average wind direction 7 a. m.	*		†	n.	ene.	.....	.....	e.
Average wind direction 3 p. m.	e.		e. by s.	se.	ene.	.....	.....	e.
Average hourly velocity 7 a. m.	6.9	7.0	1.2	1.8	.....	.....	.....	.....
Average hourly velocity 3 p. m.	8.6	12.3	5.6	5.0	.....	.....	.....	.....
Average cloudiness (tenths):								
7 a. m. Lower clouds	3.6	1.6	1.3	0.1	.....	.....	.....	.....
7 a. m. Middle clouds	1.8	1.2	0.8	0.2	.....	.....	.....	.....
7 a. m. Upper clouds	0.7	4.6	3.0	4.0	.....	.....	.....	.....
3 p. m. Lower clouds	3.9	5.9	2.2	0.0	.....	.....	.....	.....
3 p. m. Middle clouds	1.7	2.3	1.4	6.1	.....	.....	.....	.....
3 p. m. Upper clouds	0.8	0.9	4.3	2.2	.....	.....	.....	....

*e. by n. †ne. by e.

TORNADO AT HAMPTON BEACH, N. H., JULY 4, 1898.

By ARTHUR E. SWEETLAND (dated August 4, 1898).

The report in the newspapers that a destructive tornado had visited Hampton, N. H., on July 4 led Mr. A. L. Rotch and the writer to visit the scene two days after the storm.

Hampton Beach is situated on the southeastern coast of New Hampshire, 2 miles southeast of Hampton, and near the boundary line of Massachusetts. The country to the northwest and west is covered by numerous small hills varying from 100 to 300 feet in height. In the immediate vicinity of the beach, where the greatest destruction took place, there is a large marsh (Hampton Marsh) on the northwest and west side and the ocean on the east side. The beach extends in a north-northeast to south-southwest direction. The track of the storm was across the marsh from Hampton and from the northwest. The tornado, which occurred at 3:30 p. m., caused its first damage on the road one-half mile southeast of Hampton, where it overturned a large tree, the tree falling in an east-northeast direction. The next damage was in a small orchard, where two small trees were blown down, falling, like the preceding one, from east-northeast. From here

no more damage was observed until the marsh was reached, where haystacks had some of the hay blown toward the east. Leaving the marsh, the tornado then came to the beach, where the most serious damage was done. Large buildings were moved from their foundations and others were blown flat. The western end of the beach was where the greatest destruction took place and it was also the western limit of the tornado's path. At this place almost all the damage was caused by the rear whirl or northwest quadrant of the storm. One building on the extreme western limit of the path had the upper part of the roof badly damaged. Going east, another building had the main part of the house blown flat on the ground, while the laundry or kitchen was uninjured. The main part of the building was carried forward by the wind and the blinds and some of the woodwork were found in a field about 200 feet southeast of the wreck. There was no evidence of an explosive effect on this building.

Another dwelling house near was badly injured in its second story by the fragments of the barn (which was in the rear of the building) being taken up and carried around the northeast corner of the dwelling house toward the southeast. The barn was completely demolished, and the only thing left to mark the place where it stood was the floor. A large square building was moved bodily 10 feet from its foundation toward the southeast. Northeast of this building the rear of a large dwelling was moved 6 feet from its foundation posts and swung around on its southeast corner as a pivot, the plastering and other interior parts of the house being badly damaged. A short distance east of these buildings a tree was overturned toward the east. Farther along the beach toward the east there was a barn blown to the ground and parts of it were carried around a building with some hay that was cocked up by the side of it. The next building was carried forward about three feet on the foundations, which appeared to be uninjured.

About 1,000 feet farther east there were a few trees blown down toward the east. Near the trees there was a skating rink in which there had been a large number of people, and this building had collapsed, killing three and injuring many persons. To the east of the rink a windmill was upset toward the south; 100 feet south of the windmill a barn facing west and east, with large doors open on the west end, had the rear of east end blown out. Parts of the rear end were found about 50 feet southeast of the barn. The shingles were stripped from the roof of the barn in many places, and here one could follow the cracks between the boards from the ridge pole to the gutter, showing that the increased pressure inside the building had blown off the shingles.

The support of an electric arc lamp, a vertical iron pipe on a wooden pole, was bent toward the southeast and the lamp blown completely out of it.

Along the tornado track there were few buildings that did not suffer some damage, most of them losing chimneys or blinds. Telephone, telegraph, and trolley wires were blown down.

The objects thrown down by the tornado did not show the rotary motion in the front and rear as well as if the storm had traversed a forest or orchard. Most of the fallen objects pointed toward the east or east-southeast, indicating that the greatest damage was done in the rear whirl or northwest quadrant.

Most of the eyewitnesses interviewed describe the storm as coming directly from Hampton across the marsh, and one who saw the cloud describes it as turning over and over. No one seemed to have noticed any pendants (more commonly known as a funnel cloud) descending to the ground. It was difficult to get a good description of the clouds or phenomena connected with the tornado, as almost everyone was too rerrified to observe it. A person who saw the cloud from Exeter, 8 miles northwest of the beach, thought there was a large conflagration at the beach, as the light gray part of the cloud resembled smoke. The tornado was preceded by light rain and hail.

The temperature for the northeastern part of the United States from June 29 to July 4 gradually rose above normal, culminating on the 3d with the hottest day at Boston since September 21, 1881. Several of the Weather Bureau stations recorded maximum temperatures of 100°.

On the morning of the 4th the temperature was still considerably above normal, but not so warm as on the 3d. The humidity had increased so that the heat seemed more oppressive. The 8 a. m. weather map of July 4 showed that there was a low area central over the northeast with the lowest pressure, 29.68, at Sydney. A high pressure was central over the Lakes. Over the New England States the isobars were circular and the winds were mostly westerly. South of New England and over the Middle Atlantic States and Ohio Valley the isobars assumed a V shape. Along the trough of the V, thunderstorms had occurred or were at that time prevailing. In the Atlantic Coast States the temperature was quite high. The 80° isotherm ran through almost every station along the Atlantic coast from Halifax to Florida. The lowest temperature was over Lake Superior, where the 50° isotherm extended through Sault Ste. Marie and Duluth. A fall of 20° in twenty-four hours was recorded over the Lakes. Thus, quite a sharp temperature gradient was formed over the northeastern part of the country.

By 8 p. m. the pressure had increased at the center of the low to 29.8, and the low pressure had become a well marked V, extending down the coast as far south as Virginia. The demarkation of the winds were well marked along the trough, the directions being south and southwest on the east side, and west and northwest on the west side. The high pressure over the Lakes had become better defined, with the highest pressure over Lake Superior. At 8 p. m. the cooler weather covered all the Lakes and St. Lawrence Valley, and by the morning of the 5th it covered the entire northeastern part of the country.

During the 4th a series of thunderstorms of more or less severity occurred along the line of the barometric trough and passed off the coast. The Hampton Beach tornado was the northern limit of the line of thunderstorms, as no rain was reported north of there. Farther south, at Beverly, Mass., there was a severe storm, a pleasure steamer being overturned by the wind and several lives lost. In Boston the wind was not excessive, a heavy hailstorm occurring and hailstones fell varying from one-half to one and one-half inch in diameter.

At Blue Hill Observatory[1] the morning was clear with no clouds until 11 a. m., when a few fracto-cumulus formed and continued forming slowly until 1 p. m., at which time lenticular clouds formed very suddenly in all parts of the sky, and the fracto-cumulus became cumulus and increased rapidly in size. At 1:30 p. m. a thunderstorm was observed to form southwest of Blue Hill, and began to increase in size very rapidly, so that by 2 p. m. the cirro-stratus overflow extended some distance northeast of Blue Hill. Thunder was heard at 2:25 p. m., and by 3 p. m. it was raining and hailing hard, the storm continued until 6 p. m. and moved toward the northeast.

[1] Blue Hill is about 55 miles south-southwest from Hampton Beach.

NOTES BY THE EDITOR.

PROF. MARK W. HARRINGTON.

The observers and friends of the Weather Bureau will not soon forget that before Professor Harrington was appointed Chief of the Weather Bureau he had devoted his energies and fortune to the maintenance of the American Meteorological Journal and to the awakening of a general interest in meteorology as a course of instruction in colleges and universities. Among all the sciences that have important practical bearings, there is none in which the need of popular education is more severely felt. In most branches of science a few experts do the observing and investigating, but meteorology has for ages largely relied upon the work of amateurs and voluntary observers, whose daily occupation as navigators, farmers, physicists, and surveyors, etc., leave them but little opportunity to pursue any consecutive train of thought on the subject. The study of meteorology and climatology in schools and colleges will not only bring to us a high class of observers, but will benefit the individual no matter what his occupation in life, by giving him a truer insight into the operations of nature.

From this point of view, we are pleased to learn that Professor Harrington may prepare for publication an introduction to physical geography, and is ready at any time to deliver those courses of lectures on this subject, for which he has always been so famous.

OCEAN TEMPERATURES AND METEOROLOGY.

The Geographical Journal for August, 1898, published by the Royal Geographical Society of London contains an important paper by Sir John Murray, the well-known editor of the "Results of the Challenger Expedition." Dr. Murray has collected the data and published a chart showing the annual range of temperature in the surface waters of the ocean and its relation to other oceanographical phenomena. The chart takes account, not of the mean monthly temperatures and the average range from the mean of the midsummer to the mean of the midwinter temperatures but of the so-called absolute annual range or the difference between the absolute extremes of temperature. The surface temperature of ocean water is usually obtained by dipping a thermometer into a freshly drawn bucket of water. The observed temperature, therefore, relates to some indefinite depth which, owing to the disturbance of the water in the neighborhood of the ship, and especially the disturbance due to the wind and waves, may be anywhere from 1 to 5 feet below the precise surface of the water. The ocean temperatures thus obtained, should, from a physicist's point of view, be compared with continental temperatures taken at a short distance, say 3 inches below the surface of the ground. If we wish to compare the temperature of the actual surface of the soil with that of the actual surface of the water, we shall need a special arrangement and a quiet water. We shall not go far wrong in assuming that the temperatures charted by Dr. Murray are essentially the same as those of the lowest stratum of air at the surface of the ocean, but if we wish to compare these with the temperature of the air at the surface of the land on the adjoining continents we find a difficulty, owing to the fact that few, if any, stations keep a record of temperatures at the surface of the soil or of the air close to the soil. A chart of maximum or minimum air temperatures made up from ordinary meteorological data would give annual ranges considerably lower than would be given by thermometers placed on the soil and, therefore, not precisely comparable with those charted by Dr. Murray.

There are, however, many questions important to meteorology upon which this chart throws no uncertain light. The greatest annual range, exceeding 50° F., occurs over a small portion of the Japan Sea and over a larger portion of the Atlantic Ocean east of Cape Cod. The greatest recorded local range according to Dr. Murray's text is 52.7°, viz, from 28.8° F. to 81.5° F. The lowest of all the temperatures at the surface is 26° F. in the north Atlantic east of Nova Scotia, and the highest is 90° F. in the tropical Pacific and 96° F. in the Red Sea and Persian Gulf, whence the greatest general range of ocean temperature for the whole world is 70° F.

These latter figures may be compared with the temperatures on dry land. Thus, for instance, the locality that has the absolutely largest range of temperature would seem to be the station Verkojansk, in Siberia, where the lowest temperature of —93.6° F. was observed in February, 1893, and the lowest monthly mean was about —67° F., whereas the highest temperature was 101.8° F., giving an extreme absolute local range of 195.4° F. The range of temperature between the mean of the coldest month and the mean of the warmest month at this place is 120° F. If we seek for the greatest general range of air temperature over the whole globe we should probably have to compare Verkojansk with some such station as Yuma, Ariz., where the extreme highest temperature is recorded as about 120° F., and the average warmest month was about 95° F., thus giving a general range of air temperature for the whole globe of 213.6° F., and about 162° F. for the range of monthly means.

The large annual ranges of temperature of the ocean surface, viz, 25° or more in the North Atlantic and North Pacific, represent the influence of the cold northwest winds blowing off shore in the winter as contrasted with the warm southerly winds blowing on or along shore in summer. The regions of large range are, therefore, confined to the western portions of the oceans and the eastern shores of the continents. At first thought one would expect to find in Dr. Murray's lines of equal annual temperature range some traces of the course of the Gulf Stream and Kuroshiwo, but it is only the changes in the positions of these currents that can produce ranges of temperature, and these changes are so largely controlled by the wind that Dr. Murray's charts show us principally the effect upon the ocean water of the changes in the atmospheric circulation. This same principle applies also to the closed seas, such as the Mediterranean and Baltic, the Red Sea, and the Persian Gulf, in all which cases a larger range of temperature is observed at the head of the sea than at the mouth of the sea, due to the fact that the highest temperatures occur at the head when the wind blows toward that direction in the summer, and the lowest temperatures when the wind blows in the opposite direction at the opposite season of the year. There is, therefore, in this map no comfort for those who maintain that the Gulf Stream or the Kuroshiwo, respectively, alleviate or control the temperatures of the eastern portion of the Atlantic and Pacific oceans, and the adjacent portions of Europe and America, respectively. Everywhere we see that it is the wind that controls the temperature of the surface of the ocean, and then carries this ocean temperature inward over the land. The same remarks apply to the Southern Hemisphere, where Dr. Murray's chart shows that the greatest range of ocean temperatures is in the regions where there is the greatest annual range of wind direction.

POLAR VERSUS EQUATORIAL CLIMATOLOGY.

The great international campaign for the study of the meteorology and magnetism of the arctic and antarctic regions which was prosecuted by many nations simultaneously and, according to a well-arranged programme during the years 1882–'83, resulted in the publication of a noble series of volumes containing the results, and in a few cases a preliminary discussion of the general bearing of the results on some of the problems of terrestrial physics. By general agreement no one was expected to give a general résumé of the subject until all the observational data had been fully published, and as this has not been entirely accomplished one need not wonder that this great storehouse of data has not yet been exhaustively utilized. For a century to come these volumes of observations will be quoted as we advance further in our knowledge of the secrets of nature. The latest contribution to the original data has lately been published as the third volume of the records of the polar expedition sent out by Finland. This expedition occupied a station at Sodankyla north of Finland (N. 67° 27′, E. 26° 36′) as also a temporary station, Kultala (N. 68° 30′, E. 26° 46′); observations were also made in cooperation with the station Kautokino (N. 69°, E. 23°) in the province of Finmark, Norway, and occupied by the Norwegian student of auroras, the late M. Tromholt. Among other specialties, observations were also made upon the electric currents and the auroral flames visible to the naked eye in the neighborhood of the mountain Oratunturi (N. 67° 21′, E. 27° 17′).

The three volumes that contain the work done by the Finnish Expedition are due principally to Prof. Selim Lemstrom, Chief of the Expedition and Professor of Physics at the University of Helsingfors, and Dr. Ernest Biese, Chief of the station of Sodankyla and Director of the Central Meteorological Institute at Helsingfors. These, and the fifty or more corresponding volumes published by other European countries, together with the handsome volumes published by the United States Government for the polar stations occupied by General Greely and Captain Ray, stand as monuments to the conviction that formerly prevailed among scientists, to the effect that the meteorological and magnetic phenomena of the globe depends to a large extent upon what is going on in the polar regions.

On the other hand it is clear that the meteorology of the temperate zones depends to an equal extent upon what is going on in the equatorial regions and there is an increasing need of meteorogical explorations on the ocean and meteorological stations on the land throughout the torrid zone. A hundred years ago, the explorations of Humboldt in this zone, awakened an enthusiasm that should never be allowed to die out. During the past fifty years, the Spanish, Portuguese, French, and Dutch colonies throughout these zones have contributed, according to their ability, to climatological investigations; but now that German, English, and American energies have been awakened, we may hope that still more will be accomplished within the Tropics.

ROCKALL AS A METEOROLOGICAL STATION.

The Scottish Geographical Magazine for August, 1898, contains an article by Mr. Miller Christy, historical and descriptive of the famous rock in the North Atlantic Ocean known as Rockall, but in former centuries more commonly Rocol, Rochol, or Rokol. The island is but a rocky pyramid standing solitary and alone at N. 57° 36′, W. 13° 42′; it has a diameter of about 80 feet and the summit is about 70 feet above the surface of the water. It is about 470 miles from Iceland and 160 from St. Kilda, in the Outer Hebrides, and was probably known to the merchants of Bristol, who, from the earliest times, carried on a trade in dried fish with Iceland. Mr. Christy's article summarizes all that is known as to the nature, position, history, and modern scientific exploration of this interesting speck of oceanic land and the reefs and fishing banks immediately adjoining it. To the meteorologist a particular interest attaches to this rock. Several explorers have landed upon it and thus demonstrated the possibility of occupying it as a permanent meteorological station, at least during a portion of the year. But the fact that in winter time the waves undoubtedly wash over its summit may well cause one to doubt whether the maintenance of a lighthouse or an observing station will ever be a practical possibility. On the other hand, Mr. Christy suggests that it would be more feasible to moor a light-ship on some portion of Rockall Bank and utilize that as a meteorological station.

The desirability of connecting this station with the mainland by a submarine telegraph cable has been indorsed by Dr. R. H. Scott, F. R. S., secretary of the Meteorological Council and superintendent of the meteorological office at London, who has said: "If a station on Rockall could possibly be established and maintained, its value to weather telegraphy would be incalculable."

Mr. Christy estimates the cost of the submarine cable at 35,000 or 40,000 pounds sterling; the annual expense of maintenance of the light-ship would undoubtedly be large, but still feasible, and in the end economical, considering its value to the British marine.

It would seem that the character of the stone of which this rock is composed is of a new and interesting type, entirely different from that found anywhere else on the globe; Professor Hull has given it the distinctive characteristic name, rockallite, and he suggests that the nearest resemblance to it is found among the Post-Silurian dykes near Christiania, and it may be that in Rockall we have a similar intrusive mass of the same period that has escaped destruction by denudation. It is plausible that as lately as two or three centuries ago the main rock that is now still standing was surrounded by a small sand dyke and that adjacent reefs had a greater exposure than now, and that one or more additional islets then existed. Of course, the rock is a breeding place for rare birds, and Mr. Christy's article will doubtless stimulate some naturalist to explore this region more thoroughly. He says:

> It is perhaps, improbable, after the failure of the recent expedition to effect a landing, that another properly equipped expedition will be undertaken on purpose; but there are surely plenty of British and American yachtsmen, owning stout, sea-going steam yachts, who would be glad to have a definite and useful object for a short ten days' cruise, accompanied by some scientific friend, during next summer. To any such, a trip to Rockall may be recommended. Any such expedition should not be undertaken earlier than the middle of May or later than the beginning of July, between which dates the birds frequenting the rock would be found breeding, and there would be a fair probability of meeting with fine weather. It is true that there would always be a possibility that the weather at the time of the visit might not permit of a landing being effected, but a few days' dredging on the bank would certainly afford results of much interest to students of marine zoology; and, even if nothing of scientific interest were accomplished, a cruize would have been enjoyed.

INTERNATIONAL METEOROLOGICAL SYMBOLS.

In publishing scientific works that are likely to be used by students of all nations it is desirable to avoid the use of words from any one specific language, and to employ symbols that shall be universally acceptable and intelligible. The progress of science has, in general, been greatly favored by the agreement to adopt uniform notations and expressions. Mathematicians, musicians, botanists, chemists, architects and many others have their specific symbols and terms, the use of which favors the clear expression and quick comprehension of the idea that has to be conveyed. A set of special meteorological symbols was devised by the Permanent Committee appointed by the International Meteorological Con-

gress, held in Vienna in September, 1873; the symbols were slightly modified in Munich in 1892, and were recommended for use to the American observers in a circular issued by the Chief of the Weather Bureau dated January 1, 1894. These symbols are convenient for use in manuscript records and are now almost universally employed in the publications of the various international weather bureaus. They are, therefore, here presented again to the attention of the readers of the MONTHLY WEATHER REVIEW as a matter with which all should be familiar.

The absence of an exponent written above and to the right of the symbol denotes a phenomenon of moderate intensity; the exponent (°) indicates slight intensity; the exponent (²) indicates a phenomenon of great intensity.

The great saving of space and time attained by the use of the symbols is indicated by the following example and translation:

1 ◹ 9 p — 10 p in E; 3 ● 11 p —; 4 ● —10 a., ⌐◹ 3 p — 5 p.

The translation of the above is as follows: "On the 1st, sheet lightning was observed from 9 to 10 p. m., in the east; 3d, rain began at 11 p. m. and continued during the night (a dash indicates the continuance of a phenomenon); 4th, rain ended at 10 a. m. and a thunderstorm prevailed from 3 to 5 p. m.

The international symbols and abbreviations and their explanations are as follows:

1. ● RAINFALL—Indicates that an appreciable quantity of rain (one hundredth of an inch or more) has fallen during the day or since last observation; also that the day is a rainy day as distinguished from snowy or clear days.

2. ✳ SNOWFALL—Indicates that an appreciable quantity of snow has fallen during the day. ✳° may be used to denote flurries of snow.

3. ▲ HAILSTONES.—Hard semitransparent ice, whether small or large, crystalline or rounded. ▲° small quantity of hailstones; ▲² large quantity of hailstones.

4. △ SLEET—Or pellets of snow or soft hail without any crystalline structure. This symbol is used by the Germans for *Graupeln*, or snow pellets, and for the semitransparent mixture of snow and ice that in the dry weather of central Europe nearly corresponds to the sleet of the coasts of England and America. △° small quantity of sleet; △² much sleet.

5. ⋁ SILVER FROST—(English, "silver thaw," French, *givre*, German, *rauhfrost* or *duft-anhang*); this refers to an accumulation of snow and sleet on the limbs of trees, in which the snow is the main feature, so that the external appearance is silvery white and rough.

6. ⌒ GLAZED FROST—(French, *verglas*, German, *glatteis*); this refers to an accumulation of snow and ice on the trees, in which the ice is in excess and the external appearance is smooth and transparent. In using the symbols for "silver frost" and "glazed frost," the Munich Conference requests that these terms be considered as descriptive of the resulting phenomena, no matter how they are brought about, therefore the definitions avoid any statement as to the conditions attending the formation of the depositions. The same rule applies to the use of the symbol for "hoar frost."

7. ⟝ ICE-NEEDLES—(Not yet well defined by international usage).

8. ⊰ DRIFTING SNOW—(German, *schneegestober*); this symbol indicates that strong winds are raising the snow from the ground, filling the air with it like dust, and transporting it horizontally; this may occur under a clear sky. The symbol does not refer to snow falling from the clouds, nor to the mere fact that the snow is lying in drifts on the ground. When the air is filled with blinding snow dust, use the symbol ⊰². but for light winds and light snow dust use ⊰°.

9. ⊠ SNOW-COVERING—Or quantity of snow lying on the ground; when more than half the soil in the neighborhood of any station is covered with snow this is indicated by ⊠; if the snow covering is thin, use ⊠'; but if it is considered deep for that station use ⊠'.

10. ≡ FOG—Enveloping the observer; ≡° thin fog or mist enveloping and above the observer; ≡² heavy fog or mist, such as the Scotch mist, drizzling down upon the observer. Neither of these fog symbols is to be used when an observer at a high station notices fog in the valley below him; such an observation as this should only be expressed by a note in the daily journal.

11. ∞ HIGH HAZE—Such as makes distant mountains appear hazy, or such as covers the sky in the case of Indian summer haze or prairie fires; German, *moorrauch*. If clouds are also prevalent in connection with this haze, the additional cloud symbol should be given. The intensity, or density, of the haze is expressed by ∞° for light haze and ∞² for dense haze. The symbol ∞ indicates merely the hazy condition, or the optical result, without considering whether the haze is caused by dust or moisture.

12. ⌓ DEW; ⌓° LIGHT DEW; ⌓² HEAVY DEW—As the formation of dew depends upon the nature and exposure of the horizontal surface on which dew is deposited, the observer should use the same horizontal object uniformly throughout the season.

13. ⌐¬ HOAR FROST; ⌐¬° LIGHT HOAR FROST; ⌐¬² HEAVY HOAR FROST, injurious to vegetation—The expression "frosty weather" refers to the low temperature as such; but the expression "hoar frost" to the crystalline ice deposited upon the surface of solids in the open air. Hoar frost is deposited on horizontal objects generally under a clear sky at night.

14. ⟝ STRONG WIND—An arrow with four feathers indicates a wind whose strength is 8, 9, 10, 11, or 12 on the Beaufort scale, or 8, 9, or 10, on the international scale, or anything in excess of 50 miles per hour or 20 meters per second in absolute measures; ⟝² a remarkably strong wind or one exceeding 11 on the Beaufort scale, or 80 miles per hour, or 35 meters per second.

15. ⌐◹ THUNDERSTORM—Namely thunder, whether with or without lightning, rain, hail, or wind.

16. ◹ HEAT LIGHTNING—Distant lightning or any form of lightning that occurs without audible thunder, even when it occurs in the zenith, which is sometimes the case (this latter occurrence should be especially described in the journal of the observer); ◹° infrequent lightning, or lightning that is confined to a small region of the sky; ◹² lightning that occurs very frequently or extends over a large region of the sky. When distant lightning appears at a definite direction in the horizon, the observer should add the letters indicating the points of the compass, for instance, ◹° NW. 10 p. indicates that occasional heat lightning occurred in the distant northwest at 10 p. m.

17. ⓘ SOLAR AUREOLA, CORONA, OR GLORY—German, *Kranz, lichtkron*, "Corona," *Sonnenhof*. These are small circles of prismatic colors surrounding the sun, the radii of these circles are usually less than 6°, but in the extreme case of Bishop's ring, its radius was 15°. Several concentric circles are sometimes visible; each circular band of prismatic colors has its red on the outside, and its blue, violet, or purple on the inside, with respect to the sun; such rings are generally formed when the sun shines through a thin cloud and may be seen if the sun is viewed through neutral-tinted glass or by reflection in water. Similar circles surrounding the shadow of the observer's head are called "anthelia," "aureolæ," "glories," or "fog-shadows," (German, *Gegensonne, Brockenspectra*).

18. ◠ LUNAR AUREOLA OR CORONA—(German, *Mondhof*); circles surrounding the moon similar to the solar corona.

19. ⊕ SOLAR HALO—(German, *Sonnenring*); these are larger circles surrounding the sun whose sizes are quite definite, namely, about 22° and about 40° radius from the sun; they are easily distinguishable from the coronæ by the fact that the colors are feebler, and are so arranged that the red light is inside or nearest the sun, and the blue light is outside; the greater part of the breadth of the halo is white. Complex combinations of halos, parhelia, horizontal circles, and vertical columns sometimes occur, all of which may be indicated in general by the symbol ⊕², where the figure ² indicates that the display is more brilliant than usual; a detailed statement of the radii or diameters of the rings and columns and of their arrangements should be given in the text.

20. ◡ LUNAR HALO—(German, *Mondring*); phenomena surrounding the moon similar to the solar halo.

21. ◠ RAINBOW—Double rainbows and those with adjacent supernumerary bows may be indicated by ◠².

22. ⌓ AURORAL LIGHTS—Namely, any display of the Aurora Borealis.

ABBREVIATIONS RECOMMENDED FOR USE.

TIME.

a. antemeridian; p. postmeridian; n. noonday; m. midnight; h. hour. (The hours will be counted from 0 to 12, commencing with midnight.)—[The count from 0 to 24 is now widely adopted.—ED.]

TEMPERATURE.

° degrees of temperature or of a circle; F. Fahrenheit; C. Centigrade; max., maximum of temperature, pressure, or other element; min., minimum of temperature, pressure, or other element.

LENGTHS.

mi. miles; ft. feet; in. inches; kil. kilometers; m. meters; cm. centimeters; mm. milimeters.

CLOUDS.

C. cirrus; KC. cirro-cumulus; CS. cirro-stratus; K. cumulus; KS. cumulo-stratus; S. stratus; Nim. nimbus.

THE FIRST WELLMANN EXPEDITION.

Our readers will remember that in 1894 Mr. W. Wellmann, an American journalist (not a German-American as he is sometimes mistakenly called), conducted an expedition to Spitzenbergen, from which point he intended to make a journey toward the North Pole by sleds and boats. His party included Mr. B. O. French, of the Coast and Geodetic Survey,

who served as astronomer; Dr. H. Alme, of the Meteorological Office at Stockholm, who joined the expedition at Tromsoe and served as meteorologist. The general spirit of the expedition was not that of scientific exploration, but the two gentlemen here referred to accomplished all that was possible under the circumstances In 1895 the Chief of the Weather Bureau received from Dr. Alme his report communicating the meteorological results, and on consultation with Mr. Wellmann was assured that there was no objection to the publication of this report, but that he considered Mr. French as responsible for all the work. Accordingly correspondence was opened with Mr. French, who, after unforeseen delays, owing to his absence in the field work of the Coast and Geodetic Survey, has only lately been able to complete the reduction of his astronomical observations and give the proper locations and charts showing the points at which the meteorological work was done. The Editor takes pleasure in being able now to announce that the combined reports of Messrs. French and Alme will be printed as a bulletin of the Weather Bureau. It is always proper and important to publish, in all possible detail, any observations made at an isolated point so far removed from ordinary meteorological stations, and so essential in filling up the daily map for tracing storms and weather over the North Atlantic Ocean.

RAINFALL MEASUREMENTS ON SHIPS.

It has been customary for navigators, in keeping a meteorological record, to express the rainfall only in the most general terms; but, inasmuch as a complete study of the meteorology of the globe requires a positive knowledge of the amount of rainfall, it behooves us to make every possible effort to remedy this great deficiency in our knowledge. In former days it was assumed that the rain gauge must be a fixture with its mouth perfectly horizontal at an elevation of not more than 1 foot above the earth's surface, while a gauge set in a shallow pit so that its mouth is on a level with the surrounding soil was widely adopted as the standard. The invention of shielded gauges by Prof. Joseph Henry, in 1858, and Professor Nipher, in 1878, and of the protected gauge of Bœrnstein, in 1884, together with a better appreciation of the action of the wind upon the gauge, as affecting its catch, have effected a radical change in our views. The height of the gauge above the ground does not materially affect the catch or the apparent rainfall, provided that we adopt some method of annulling the influence of the wind. Shielded or protected gauges give the same rainfall in all open localities, and it seems to be high time that they should be established and used at sea. The errors to which such gauges will then be subject will arise principally from the fact that they are liable to be in the shelter of a sail or bulwark, of a deck house or a smokestack. If established on a steamer near each end of the bridge occupied by the pilot or navigating officer, the average of the two gauges can apparently only be affected by the influence of the rolling of the vessel, and if mounted on gimbals, this latter is reduced to a minimum. If established on a steamship or sailing vessel, the gauge that is to windward of the sail should be employed; but the gauge that is to leeward should be read and recorded, in order to appreciate the amount that it has lost by its sheltered position.

The latest effort in this line of work is that of Dr. W. G. Black, whose paper on this subject, read before the Manchester Geographical Society in October, 1897, is summarized on page 206 of its Journal, Vol. XIII. The complete paper is published, with a chart of ocean rainfall, in the same Journal, Vol. XIV, pp. 36–56. Rainfall tables are given for each ocean, based on observations made with marine rain gauges (generally Dr. Black's pattern of 1870–72), during many voyages between 1864 and 1880, by about twelve steamships or steamers. Dr. Black illustrated his address and explained the use of the large box and small leather rain gauges; the gimbal stand for the rain gauge, with its ring and dish and louvre protection, and, finally, the wind gauge. The following are the conclusions to which Dr. Black has come on the question of oceanic rainfall:

1. More rain falls at sea in the Northern Hemisphere (Atlantic, Indian, and China seas) than in the Southern Hemisphere, by 91.15 inches to 66.33 inches; but there are fewer rainy days, by 162 to 182.

2. The rate of rainfall is heavier in the Northern Hemisphere than in the Southern Hemisphere by 0.562 inches to 0.364 inches per diem of wet days.

3. The percentage of wet days to total days in the Northern Hemisphere is about 24, and in the Southern Hemisphere is 23.

4. Most rain was collected in the month of September in the Northern Hemisphere, and in April in the Southern Hemisphere, both being autumn months.

5. The rate of rainfall per annum in the Northern Hemisphere was 50.56 inches and in the Southern Hemisphere 30.76 inches, or two-fifths less.

6. Least rain was collected in March in the Northern Hemisphere and in October in the Southern Hemisphere, both being spring months.

7. The greatest number of rainy days in the Northern Hemisphere was in September, 33, and in the Southern Hemisphere in April, 25; autumnal months.

8. The least wet days in the Northern Hemisphere were in March, 5; in the Southern Hemisphere, 1, in October; spring months.

We have, unfortunately, no further details of Dr. Black's apparatus, but we have no hesitation in recommending shielded or protected gauges, whether on gimbal stands or not, for general use at sea, as being a great advance over our present absence of rainfall measurements.

CLIMATES OF GEOLOGICAL AGES.

An article by Prof. T. C. Chamberlin in the Journal of Geology for November, 1897, vol. V., p. 653, contains a review of a number of hypotheses bearing on climatic changes during geological ages. In common with all modern geologists, Professor Chamberlin recognizes that the atmosphere is the most active of all geological agencies.

> Its very activity destroys its relics almost as soon as formed and gives them peculiar evanescence. This has invited the neglect of geologists laudably prone to concentrate their attention upon agencies which have left enduring and unequivocal records. * * * All our attempts at the solution of climatic problems proceed on some conscious or unconscious assumption concerning the extent and nature of the atmosphere at the stage involved.

After showing that the carbon dioxide now in the atmosphere would not last ten thousand years at the present rate of consumption, and that we are confronted by the necessity of finding some compensating source of supply, he appeals to the ocean as being an atmosphere in storage, holding in solution about eighteen times as much carbon dioxide as does the atmosphere itself. He finds that the flora and fauna of Paleozoic and Cenozoic times do not imply any great difference between the earlier and the present atmosphere, but that during the Carboniferous period there may have been many thousand times as much carbon dioxide as now. One might assume that our atmosphere has been successively fed and robbed of this gas. After computing from the best data available the power of a hot atmosphere and molten earth to retain the various gases whence it follows that hydrogen, at least, would escape into space away from the earth's attraction quite

rapidly, and after accepting the probability that in some way or other the earth and atmosphere have received compensating accretions slowly by the fall of meteorites without an appreciable increase of temperature, he proceeds to work out this idea more in detail, finding many analogies in the present condition of the moon. In general, our atmosphere was derived from the interior of the earth, but after the earth had reached the requisite size, it would be supplemented by the collection of wandering gases. All this, of course, took place while the temperature of the surface was above that of boiling water and before the ocean, as such, could exist. The combined mass of the atmosphere and the ocean are little more than $\frac{1}{5000}$ of the mass of the earth. At that time the matter that now constitutes an earth of average specific gravity 5.6 was so swollen by heat as to have an average of 3.5. If we consider this mass as simply contracting to its present dimensions, the corresponding fall of each particle toward the earth's center would, by the conversion of gravity into heat, be capable of raising the whole mass to a temperature of 6,560° C., or far above the average melting point of rocks on the surface. Whether or not the earth and atmosphere ever went through this particular stage in progressive self-condensation, it is at least probable that something like that must have gone on in connection with the formation of the ocean depressions and continental elevations and the subsequent great crumplings and crushings of Archæan ages.

The mountainous wrinkling of the crust in Post-Cambrian times is now going on in this epoch in gentle earthquakes. * * * There does not, therefore, seem to me any firm ground, even on current theories of the earth's origin, for insisting on the acceptance of the doctrine of a vast primitive atmosphere, as the great reservoir from which subsequent abstractions have been chiefly taken. I think we are free, therefore, to assume just such a Paleozoic atmosphere as the life and deposits of that time seem to imply, interpreted by the phenomena of to-day. Such an interpretation seems to me to indicate conditions not radically dissimilar to those of the recent geological ages; warm climates in high latitudes at times, colder climates in lower latitudes at times, moisture at times, aridity at times, and like oscillations. This view carries with it the necessary corollary that the atmosphere has been suppliedby accessions in some new proportion to its losses.

The author then gives some plausible reasons for the fluctuation in supply and exhaustion of the atmosphere; among these it is noticed that when a general uplift of the crust occurs the area of the ocean is diminished and the area of high land increased with an increase of the atmospheric exhaustion or impoverishment, so that, in general, atmospheric poverty lags some distance behind the stages of general elevation and *vice versa*. The author also assumes that atmospheric poverty, especially in the critical item of carbon dioxide is correlated with low temperatures. Tyndall suggested that carbon dioxide had a peculiarly powerful influence in absorbing solar radiation, and Arrhenius has lately computed what degree of depletion of the carbon dioxide at present in the atmosphere would bring about the glaciation known to have prevailed in Pleistocene times. He finds that the removal of 38 to 45 per cent will do this and that, on the other hand, an increase of two or three times its present value would produce the mild temperatures of the Tertiary times. But the elevation of a continent, the resulting glaciation and diminution of forests, or other plant life, eventually checks the absorption of carbonic acid gas, and by leaving more of it in the air, contributes to warm the atmosphere and check the glaciation. We have, therefore, an alternation of cold and warm periods due to the interaction of elevation and carbon dioxide.

Meteorologists and climatologists will certainly be pleased to find geologists agreeing that the climatic peculiarities of Pleistocene and subsequent ages were due to an atmosphere similar to that which now envelopes the earth; that oceans and continents in those days were not so greatly different from the present day, and that the great climatic changes required to cover the interior of the United States and Canada with a vast glacier similar to that which now covers Greenland, may have been brought about by a redistribution of highlands and lowlands. The problems of geological climatology are thus brought within the realm of the modern climatologist. The arguments that apply to existing climates will also apply to those of earlier eras. When we can explain why it is that glaciers are now formed in Greenland but not in our Lake region then we shall be able to state the conditions under which formerly glaciers were formed in the Lake region but not in Greenland. To the Editor these seem to be merely questions of aerodynamics.

Given a certain distribution of highland, lowland, and ocean over the whole earth's surface, we hope eventually to be able to deduce the resulting climatic peculiarities, and to show that very slight changes in oceans and continents have produced all the variations of geological climates, and that little or nothing need be hypothecated as to the variations of solar heat, of atmospheric gases, of terrestrial latitudes, or the many other climatological elements.

BAROMETRIC READINGS CONVERTED INTO STANDARD PRESSURES.

In the Annual Report of the Chief Signal Officer for 1881, pages 1126–1137, will be found a study of the corrections to the standard mercurial barometer of the Signal Service, in which instrument English scales and Fahrenheit thermometers are used. In this work it was proper to assume that the temperature of the brass scale and that of the mercury inside of the glass tube might differ appreciably, possibly by several degrees. Therefore thermometers were so placed as to give each of these temperatures separately. Two tables were computed, which were published at the close of the article referred to, by means of which the correction for temperature of the scale might be obtained and applied independently of the correction for the temperature of the mercury.

In using these and similar tables of corrections, it is assumed that the zero of the scale is precisely at the end of the ivory point to which the mercury is adjusted in the cistern of the barometer, so that, for instance, 30.500 on the brass scale really means that exact number of apparent inches on a brass scale whose coefficient of expansion for 1° F. is 0.0001043 of the observed length. It is also assumed that the average temperature of the scale is exactly known by means of several thermometers, if need be, whose individual errors have been allowed for. It is furthermore assumed that the brass scale is of correct standard length only when its temperature is 62° F. If b'' is the observed scale reading or "apparent length," and t'' is the observed temperature of the scale, then the correction for the reduction of the scale to standard length is computed by the formula:

$$\text{Correction} = b''\,(t'' - 62°)\,0.0001043.$$

This formula is represented by the following abstract of Table I:

TABLE I.

t''.	b''=29.5.	b''=30.5.
° F.	*Inch.*	*Inch.*
30.....	−0.0098	−0.0102
40.....	0.0068	0.0070
50.....	0.0037	0.0038
60.....	−0.0006	−0.0006
70.....	+0.0025	+0.0025
80.....	0.0055	0.0057
90.....	0.0086	0.0089
100.....	+0.0117	+0.0121

Having corrected the brass scale reading so as to get the height of the mercurial column in standard inches, we must

now correct this latter height for the influence of the temperature of the mercury on its density. The density of mercury at the melting point of ice, or 32° F., is adopted as the standard, and the correction that we now need is computed by the formula:

$$\text{Correction} = -b' \frac{(t'-32°)\,0.000101}{1+(t'-32°)\,0.000101}$$

which formula is represented by the following abstract of Table II. In this abstract the Editor has adopted the international value 0.000101, instead of the 0.0001001 that was used in 1880.

TABLE II.

t'	$b'=29.5$.	$b'=30.5$.
F°	*Inch.*	*Inch.*
30.....	+0.0060	+0.0062
40.....	−0.0238	−0.0246
50.....	−0.0536	−0.0454
60.....	−0.0832	−0.0860
70.....	−0.1128	−0.1166
80.....	−0.1424	−0.1471
90.....	−0.1719	−0.1777
100.....	−0.2012	−0.2080

These two tables may be combined into one if the temperatures of the scale and the mercury are identical.

After these two corrections have been applied to the original scale readings, the next step is to correct for the influence of capillarity, imperfect vacuum, erroneous density of mercury, error in zero of scale, and other instrumental matters. All of these are minutely investigated before using the so-called normal barometers, such as those at the International Bureau of Weights and Measures at Sevres, near Paris, but it would be impossible to study them in such detail at every meteorological station, therefore, before using any station barometer, it is compared with these international normals, either directly or through an intermediate portable barometer. Such comparisons give a small correction that sums up all the constant outstanding differences, and which is known in the Weather Bureau as the *correction for instrumental error and capillarity*, or more properly, the *constant correction* as distinguished from the variable ones that depend on pressure, temperature, and time. It is also known as the *reduction to Kew*, or *to Washington*, or *to Sevres*, according as one or the other is adopted as standard.

After applying this small constant correction, as well as the two above-described corrections for temperature, the result is called the apparent barometric pressure, viz, the pressure of the atmosphere as measured by the true height in standard English inches of a column of mercury having the standard temperature of 32° F., and whose weight or downward pressure is that due to the local force of gravity.

It would be more in accord with our ordinary methods of measuring pressures if we should express the atmospheric pressure in pounds per square inch, as we do the steam pressure in an engine boiler; at sea level our atmospheric pressure varies between 14 and 16 pounds to the square inch, and the height of the barometer varies in a corresponding manner between 28 and 31 inches; even although we speak of a pressure of 30 inches, yet it must always be remembered that we mean a pressure of about 15 pounds to the square inch, or one that will sustain a column of mercury 30 inches high.

The elastic force or the pressure of steam within the boiler depends upon its temperature, and for the same temperature the pressure would be the same, no matter whether the boiler were at the North Pole or at the equator. The pressure of the wind depends upon the velocity and the density of the air. In all meteorology we measure velocities, rainfall, and temperatures by standard measures which are the same the world over, but when it comes to atmospheric pressure we have too long allowed ourselves to retain the custom introduced by Torricelli and measure it by the height of a cylindrical column of mercury, whose pressure at the bottom is its total weight, which must vary with the force of gravity, so that 30 inches of mercury at the equator means a less pressure per square inch than 30 inches at any other latitude up to either Pole. If we wish to express pressures in a uniform standard measure, or as we ordinarily say in standard units, we must pass from apparent to true pressure by allowing for the difference between the local force of gravity and some adopted standard value of that force, such as its value at sea level and at the latitude of 45°. We might measure pressure by using some barometric apparatus, such as the aneroid barometer or the thermo-hypsometer, whose indications are not affected by gravity, but if we use the mercurial barometer then its readings must be corrected for gravity, that is to say, they must be reduced to standard gravity. The reduction necessary, on account of the variation of gravity with latitude, may be obtained from tables published by the International Meteorological Committee of which the following Table III is an abbreviation:

TABLE III.

Latitude. (N. or S.)	Relative force of gravity.	Reduction of mercurial barometer to standard gravity.		
		27.0	29.0	31.0
		Inch.	*Inch.*	*Inch.*
0°.....	0.9974100	−0.070	−0.075	−0.080
10°.....	0.9975662	−0.066	−0.071	−0.075
20°.....	0.9980159	−0.054	−0.058	−0.062
30°.....	0.9987050	−0.035	−0.038	−0.040
40°.....	0.9995503	−0.012	−0.013	−0.014
50°.....	1.0004497	+0.012	+0.013	+0.014
60°.....	1.0012950	+0.035	+0.038	+0.040
70°.....	1.0020409	+0.054	+0.058	+0.062
80°.....	1.0024338	+0.066	+0.071	+0.075
90°.....	1.0025902	+0.070	+0.074	+0.080

But the force of gravity also diminishes slightly as the altitude increases above the earth's surface. Consequently at great altitudes any given height of the mercurial column corresponds to a pressure that would at sea level be measured by a somewhat shorter column. If, therefore, we measure atmospheric pressure by means of the height of a column of mercury we must add a second slight gravity correction for the height of the barometer above the sea level, and this correction is also expressed in a table of the international collection, of which the following is an abstract:

TABLE IV.

Altitude of station.	Barometric pressure.				
	18 inches.	21 inches.	24 inches.	27 inches.	30 inches.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000 feet.....	.....	.....	−0.001	−0.002	−0.002
5,000 feet.....	.....	−0.007	−0.007	−0.008	.....
10,000 feet.....	−0.011	−0.013	.....	.....	.....

In general, it will be seen that at low altitudes and for ordinary pressures this small correction amounts to about 0.001 for every 500 feet of altitude, but is only one-half of this amount when the altitude has attained 10,000 feet. Considering the world at large we may say that the corrections for gravity depending on latitude and altitude amount to about one-third as much as the corrections for the temperature of the mercury and the brass scale respectively.

We now have true instead of apparent atmospheric pressure expressed in inches on a system that is uniform, no matter what the latitude, altitude, or temperature, and if we wish to convert these inches into the more appropriate terms "pounds to the square inch" we have only to multiply them by 0.4906, which is the weight in pounds of a cubic inch of

mercury, whose temperature is 32° F. Consequently a pressure of 30 standard inches corresponds to a weight under standard gravity of 14.718 pounds to the square inch. If measurements by the mercurial barometer are always corrected for the variations of gravity, and then converted by means of this latter constant factor, we shall obtain true pressures in pounds per square inch that are directly comparable with each other, no matter where the barometer may be located.

NOTES FROM THE JULY REPORTS OF THE CLIMATE AND CROP SECTIONS.

ARIZONA.

This is one of the most interesting States from a meteorological point of view. For many years the low pressure during the summer months was a conundrum that seemed impossible of explanation, but now we have every reason to believe that Arizona must be regarded as lying at the northern extremity of a narrow region of low pressure that extends from the equatorial Pacific northward over the Gulf of California; as soon as this was made clear it was seen that the low pressure in the summer at Yuma was not a local statical phenomenon but a part of the general feature due to the dynamics of the atmosphere, and depending, therefore, upon the winds and upper currents in the air. As this area of low pressure shifts its position slightly there occur local storms, but both the shifts and the local storms must be considered as the results of atmospheric changes going on at a considerable distance. For instance, on July 13–14 pressure was low in Arizona and the Gulf of California, while it was high on the coasts of California and Oregon. These conditions resulted in cloud-bursts and other local storms reported on the 15th and the wind and sand storms with light rain on the 16th. In general a flow of air southward through Arizona means a descent from high plateaus to sea level, which usually brings warm, dry clear weather to the lowlands. The present month, however, was normal as to temperature, with rainfall slightly in excess.

GEORGIA.

On the 1st at Marietta heavy thunder came from an almost cloudless sky, then a small cloud appeared and in ten minutes hail was falling. This is a pretty illustration of the origin and growth of local storms. One can scarcely doubt but that this small cloud grew in ten minutes to be a large one by virtue of the rapid ascension of a large mass of air, and the equally rapid descent of a similar mass in some neighboring region.

A similar purely local storm occurred on the 23d at Atlanta, where 4.32 inches fell in two hours, and half of that in forty minutes. The storm was purely local, so that points a mile or two from the city had comparatively little rain. Although the storm is said to have moved from southwest to northeast, yet, it would seem from this to have scarcely moved at all. In fact there are so many similar cases on record that one can not doubt but that very often a mass of moist air ascending nearly vertically carries up not only the moisture that is to be condensed and fall as rain, but an additional mass that ascends a little farther, then overflows and subsequently descends as dry air. It may be difficult to explain why such a stream of ascending air should remain within a mile or two of being stationary for two hours but, in general, we may say that under areas of high pressure the general horizontal movement is so gentle that if a mass of moist air once acquires a decided tendency to rise there is no special reason why it should not ascend vertically followed by other air in the same line of flow and constitute a complete vertical circulation of ascent and descent. A remarkable illustration of this same character occurred in August, at Washington, D. C.

ILLINOIS.

But twelve stations reported more than 2 inches of rainfall on any one day during the month and those mostly in the southern districts, therefore, when Elgin reports a very violent thunderstorm on the evening of the 19th, with some symptoms of a tornado, and yet measured only 0.043 inches of rain, we are constrained to note that the expression "very violent thunderstorm" seems to us rather misleading. The prominent characteristics of the thunderstorm may be either lightning, thunder, wind, hail, one or all of these. It would be more precise if one could make the entry read thus: "Storm with violent wind," or "with heavy rain," or "with excessive lightning and thunder." The International system of symbols could also be applied with clearness and economy of space, thus: "Storm on the 19th., lightning^2, thunder^2, rain^9, hail^9, wind^1." Here we have all the meteorological phenomena briefly recorded with as much accuracy as is ordinarily called for. (See the International Meteorological Symbols on page 311, of this number of the MONTHLY WEATHER REVIEW.)

IOWA.

An extraordinary rainfall, continuing three hours and amounting to 12 or 13 inches, is reported at Blanchard, on July 6. Blanchard is in Page County, in the southwestern corner of the State, and this record harmonizes with the report from Missouri for the same afternoon and evening, except only that the highest measurement was 8.15. There seems to have been a tendency to very heavy rain west of Iowa and Missouri in Nebraska and Kansas, as shown by the morning weather map of that date. The surface winds had been flowing from the southeast for two days and the general features of the maps for July 6–7 illustrate a principle that has been remarked ever since the first summer of study of the daily weather map, namely, that the flow of air from the south and east can not carry moisture up the western plains to a height of 1,000, 2,000, or 3,000 feet without being followed by severe local rains in the eastern portions of Indian Territory, Kansas, and Nebraska, and the western portions of Arkansas, Missouri, and Iowa. Somewhere in its gentle ascent this air must flow over on itself, which overflow is stimulated by the sun's action in heating the ground and lower stratum of air.

The Iowa reports are always full of interesting reading matter. We note among other things a short extract from Mr. E. J. Prindle's article on weather forecasts, who says: "The first attempt at scientific forecasting of the weather was the result of a storm which during the Crimean war, November 14, 1854, almost destroyed the fleets of France and England." The Editor may remark that the distinguished French astronomer, Leverrier, gives some account of the inauguration of daily telegraphic bulletins and weather predictions in France in the historical introduction to the first volume of his Atlas of the General Movements of the Atmosphere. In 1854 he was one of the most active astronomers of the world, but at that time the Paris Observatory busied itself only with its own local meteorological observations as a single station. It was Leverrier who noticed the apparent bodily movement of the storm in the neighborhood of the Crimea, in November, 1854, and who spoke of it to the Minister of War, Marshall Vaillant, thereby leading the latter to ask him, as the foremost scientist of the French Government, to investigate that storm, and eventually to organize at the observatory a bureau for the collection of weather telegrams and the prediction of storms. In February, 1855, Leverrier submitted definite proposals for this object, and his system of daily bulletins for French stations only, began in 1856. In 1858 this bulletin assumed the form of a regular publication, and was eventually extended so as to cover the whole of Europe, and became the Bulletin International. A first

weather prediction was attempted by Leverrier in April, 1857, and regular storm warnings for French ports, in 1859. The publication of the Bulletin was soon transferred to the meteorological observatory at Montsouris, under Marie-Davy, and subsequently to the Central Meteorological Bureau, under Mascart, as at present. In 1859 Elie de Beaumont writes that he found the International Bulletin very useful for weather predictions, and Leverrier began his warning dispatches to French ports when storms were apprehended. Regular weather predictions began to be published in the Bulletin August 12, 1863. They were called "probabilities," and were signed by Marie-Davy; but after a while they began to be signed alternately by G. Rayet and E. Fron. The daily weather chart to accompany the Bulletin began with the issue of September 12, 1863.

It is very evident to the careful historian that this great work of Leverrier is not the beginning of the history of modern weather telegraphy and predictions. For many years previous to his work the subject had been thoroughly canvassed in the United States. Leverrier only carried out in Europe the earlier ideas of the Americans, Espy, Redfield, and Henry. From 1849 to 1860, the latter carried on telegraphy, maps, and predictions at Washington, but without the assistance of government patronage. The history of Glaisher's work in London, 1849–51, has been given in the MONTHLY WEATHER REVIEW, 1897, pp. 205–206. Fitzroy began his storm signals in England in 1860, and Buys-Ballot in Holland in 1861. All these cooperated with Leverrier in developing this branch of practical meteorology, but Leverrier was really the third or fourth to enter the field, although he was the first to obtain support from any national government.

The current Iowa report describes a case of ball lightning on July 27, at Keokuk. While a distant thunderstorm was still at an hour's distance a ball of fire descended almost perpendicularly, leaving no illuminated path, and accompanied by a sharp report like that of a rifle, several large sparks seemed to fall slowly in the vicinity where the ball struck. Persons in the house at the time received no shock, although one sat within 6 feet of the spot where one of the weaker discharges struck.

MARYLAND AND DELAWARE.

The record of thunderstorms is very full. The Editor has a special interest in some very local storms that occurred on the 19th and 20th. From the Section Report we perceive that thunderstorms were recorded on that day at 22 stations out of the 32 that are quoted in the thunderstorm records. From the table of rainfall on each day of the month we see that rain fell at every station for the day ending 8 a. m. of the 19th, and at two-thirds of the stations during the subsequent twenty-four hours. The history of individual thunderstorms and the paths of local rains from individual cumulus clouds can not be written with any certainty until we have a network of rainfall stations less than five miles apart, or at least 400 for Maryland alone. The extremely local character of our heaviest wind and rainstorms in the summer time is shown by the fact that on the 20th, at about 1:20 a. m., a heavy cloud with a flood of rain and an 80-mile wind passed over Boyds station, in Maryland (about 30 miles northeast of Washington, D. C.) destroying telegraph and telephone poles, trees, and crops. The storm lasted for about twenty minutes and then passed on, disappearing in a portion of Montgomery and Howard counties, where there are no telegraph or telephone stations within a region of 50 by 20 miles. Nothing was seen of this storm at Beltsville, 12 miles from Washington, but there was a temporary cloudiness and threatening weather for an hour or two, just as there was at Washington itself. The Editor has been unable to obtain any further records of this particular storm, and this fact forces one to be very cautious in expressing a confident hope as to the success of local storm predictions for the city of Washington. The telegraph and telephone stations northwest and southwest of the city are not so well distributed for forecasting local storms as would seem to be desirable; but a few additional stations, such as may be expected in a few years will, undoubtedly remedy this difficulty. Baltimore is not much more favorably situated in this respect. Meanwhile, and as preparatory to such predictions, it behooves us to plot and study the paths of as many local storms as we can, confident that the knowledge thus acquired will soon find an important application.

MONTANA.

On the 17th, near Martinsdale, in Meagher County, "at 6 p. m., a horse was killed by lightning from an almost cloudless sky while feeding on the flat bottom land, and no other object near; at the same time a heavy shower occurred 6 miles to the west." Such cases as this illustrate several points, two of which we will refer to. (1) The shower 6 miles distant, and the cloud from which it fell were attended by what is called an electrical disturbance. In fact. such disturbances may occur without a shower or a cloud, but this is rare. The electric disturbance affects the atmosphere to a considerable distance; for instance, flashes flow from the lower end of a kite wire in response to every lightning flash 50 miles away, and a crackling noise is heard in the telephone when the thunderstorm is beyond the horizon. One may often see a flash emanate from a cloud near the center of a storm, while other flashes simultaneously dart from the farther end of the same cloud toward the ground far away. (2) In general, we must recognize that the electrical disturbance extends to a great distance on all sides of a storm, and at present it is idle to attempt to explain why one object rather than another is struck by the flash, or to maintain that one locality is safer than another. As this case is that of a horse feeding on the flat bottom land, we may, perhaps, be justified in imagining that he himself was the only object that rose above the uniform level of the plain, and that this fact made him peculiarly liable to be struck. This is the reasoning in accordance with which men are urged not to take shelter beneath a tree in an open field when a thunderstorm is approaching. It is also on this principle that a sharp-pointed lightning rod, erected in the middle of a field, should serve as a path for the flash and thus protect animals and men.

NEW ENGLAND.

The reproduction of Dr. Frankland's theory of the dry fog as published in January, 1879, Vol. XXVIII, p. 238 of the Proceedings of the Royal Society of London (not the Royal Meteorological Society) calls for a word of explanation. The students of capillarity or surface tension, and its relation to evaporation have shown long since that minute globules of water do not readily part with their moisture, so that the air about them may remain dry for a long time, much longer than if the air was in contact with a flat surface. It is not necessary to explain ordinary dry fogs on any other physical principle except this. On the other hand, if one wishes to adopt Frankland's hypothesis that an oily film coats every fog particle he should find some means of demonstrating that this is the fact. It is true that by special laboratory methods fog particles of this kind may be manufactured; but it is very doubtful whether they exist in natural atmospheric fogs. However, the matter can easily be decided in our smoky cities if observers will collect the mass of fog particles by forcing the foggy air to bubble through a vessel of clean water, which latter would thus soon become coated with a visible oily film. Dr. Frankland says that the oily film has a strong tendency to leave the drop and attach itself to the solid support, leav-

ing the surface of the water partially unprotected. This shows that the surface tension of the oily liquid is much less than that of the water. If aqueous vapor should begin to condense upon a minute drop of oil as a nucleus, then, at some time in the history of the growth of the drop, the oil should escape from the center and become the surface film of the drop and retard its future growth as a drop of water. This whole subject lends itself to a beautiful series of experiments, such as might be carried on by the students of physics in the well equipped laboratories that are now so common in our universities and agricultural experiment stations.

NEW JERSEY.

A heavy thunderstorm and a disastrous stroke of lightning by which 5 men were killed and 3 were seriously injured occurred on Tuesday afternoon, July 19, near Boonton. It seems that the party took refuge under a tree on the banks of the Rockaway River. The Boonton Bulletin remarks:

Notwithstanding the many warnings about seeking shelter under trees during thunderstorms, many persons when caught out in a storm run to the trees. We regret to say that this fearful catastrophe is another illustration of the thoughtlessness of people under such circumstances.

Is not this too severe an arraignment? Doubtless the unfortunate men had heard that trees were dangerous but where else could they flee from the the storm? If they had sat upright in their boat anchored on the river, they would, like the poor horse in Dakota, have been as it were a projection above the plane of the water surface and, therefore, especially liable to be struck. Had they walked farther up the river banks beyond the trees, with umbrellas over their heads and fishing poles in their hands, they would also have acted as lightning rods to attract the flash. Had they hastily erected a genuine lightning rod and then retreated a few feet from it, they might possibly have been safe. But except for this, we know of no way by which they could have insured their safety. We can not attribute their deaths to their own thoughtlessness; they ran from one danger only to run into another, and it is not for us to say that the very slight chance of being killed by lightning—which hangs over all of us at all times—need enter into consideration when we are trying to escape the greater peril of high wind, heavy rains, and hail.

NEW YORK.

All section reports for the month of July pay especial attention to the amount of damage by lightning which subject will be summed up exhaustively in the Annual Report of the Chief of the Weather Bureau. As the July report for New York could not be published in time for consultation by the Editor, Mr. R. G. Allen has kindly sent, in advance, the following item with regard to loss by lightning:

Voluntary observers and crop reporters in this section report that the thunderstorms in the different parts of this State, during July, were more violent than ever before known by the oldest citizens. They occurred on the 3d, 4th, 9th, 11th, 18th, 19th, 20th, 21st, 23d, 24th, 25th, 26th, 28th, and 29th. The amount of loss was unprecedented. The following is a brief summary of casualties:

Seventeen (17) houses struck, total loss, $1,138; thirty-seven (37) barns burned, total loss, $44,536; value of stock killed by lightning amounted to $2,190; four (4) churches were struck, and were injured to the extent of $600; a large planing mill at Moira was burned with a loss of $12,000; the Stephenson Brewing Company at Oswego was struck by lightning and burned, the loss being $150,000; sum of all losses reported to the Ithaca office was $210,464. It is a noticeable fact that nearly all of the barns burned contained grain or hay, or both.

The distribution of this destruction on different days of the month was as follows:

Date.	No. of localities.	Value of property destroyed.
July 3...	4	$3,450
4...	1	1,000
11...	1	130
18...	6	17,611
19...	9	158,770
20...	1	100
21...	5	1,380
23...	14	15,038
24...	1	250
25...	9	6,860
26...	3	3,670
28...	5	2,080
29...	2	125
Total...	.....	$210,464

BRIGHT METEORS.

The Editor has recently received glowing accounts of something extraordinary in the way of aerolites or great meteors that are said to have fallen "in the back country up river," in June, in West Virginia. Parties are said to be out searching for some of the pieces, but the Editor fears that they will never be found. When a great meteor falls it is apt to be seen for a few seconds over a wide extent of country. This particular meteor was observed near Findlay, Ohio (N. 41° 3′; W. 83° 40′), and appeared to fall somewhere eastward. It is also reported from Point Pleasant, W. Va., on the Ohio River (N. 38° 50′; W. 82° 10′), where it appeared to fall somewhere back of Hawksnest; that is to say, still somewhat to the east. If these observations are reliable they simply point to the fact that a meteor passed eastward through the atmosphere on June 3, high enough up to be seen from distant points; but the detailed account about its actual fall to the ground must be a matter of imagination. Undoubtedly some meteors do reach the ground, but it is best not to describe such a fall until after the pieces have been found. Most of the bright meteors that seem to strike the ground beyond the distant horizon have actually been hundreds of miles distant, and are consumed in the air without striking the ground.

RECENT EARTHQUAKES.

No disturbances were reported during July from the seismoscopes of Professor Morley, Cleveland, Ohio, and Professor Marvin, Washington, D. C.

July 21.—Rivas, Nicaragua, slight shock at 11:55 p. m.

July 23–24.—Chile: During the night at Conception, and at Talcahuano, 8 miles distant, a violent shock lasting a minute and destroying many houses.

July 25.—New Hampshire: Concord and Canterbury, about 6 p. m.

METEOROLOGICAL TABLES AND CHARTS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum

temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table IV gives, for 26 stations selected out of 113 that maintain continuous records, the mean hourly temperatures deduced from the Richard thermographs described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table V gives, for 26 stations selected out of 104 that maintain continuous records, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table VI gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table VIII gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table IX gives, for about 70 stations, the average hourly sunshine (in percentages) as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table X gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XI gives the record of excessive precipitation at all stations from which reports are received.

NOTES EXPLANATORY OF THE CHARTS.

Chart I.—Tracks of centers of high pressure. The roman letters show number and order of centers of high areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the highest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a ridge of high pressure.

Chart II.—Tracks of centers of low pressure. The roman letters show number and order of centers of low areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the lowest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a trough or long oval area of low pressure.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level isobars and isotherms, and resultant winds. The wind directions on this Chart are the computed resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and are reduced to sea level and to standard gravitv. The reduction for 30 inches of the mercurial barometer, as formerly shown by the marginal figures for each degree of latitude, has already been applied.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Surface temperatures; maximum, minimum, and mean. Lines of equal monthly mean temperature in red; lines of equal maximum temperatures (broken) in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

TABLE I.—*Climatological data for Weather Bureau Stations, July, 1898.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.																														
Eastport	76	69	74	29.94	30.08	+ .10	66.4	+ 0.2												3.78	+ 0.4									
Portland, Me	108	81	89	29.90	30.00	+ .08	60.2	— 0.2	87	4	68	47	1	52	32	57	55	86	0.66	— 3.2	6	5,539	s.	24	s.	25	8	11	12	5.5	
Northfield	872	15	65	29.12	30.03	+ .09	67.8	— 0.7	97	3	75	52	11	60	34	62	58	75	1.78	— 1.8	11	5,218	s.	27	nw.	15	10	8	13	6.4	
Boston	125	115	181	29.91	30.04	+ .10	68.0	+ 2.9	94	3	81	34	12	55	42	62	58	71	1.66	— 1.5	11	5,813	s.	36	nw.	9	7	19	5	5.8	
Nantucket	14	43	54	30.05	30.06	+ .05	71.8	+ 0.5	99	3	80	55	11	64	30	65	62	75	4.42	+ 1.0	12	6,855	sw.	36	n.	21	9	13	9	5.0	
Woods Hole	22	51	57	.....	.....	.....	67.3	+ 0.1	80	3	73	54	7	62	30	64	64	93	2.93	+ 0.5	8	6,484	sw.	34	n.	14	9	6	16	5.7	
Vineyard Haven	.....	20	.....	.....	.....	.....	68.2	0.0	85	3	73	56	7	63	24	.....	.....	.....	5.18	+ 2.1	7	7,710	s.	40	nw.	13	13	10	8	6.8	
Block Island	27	39	48	30.04	30.07	+ .10	71.3	+ 0.4	91	1	79	56	8	64	27	.....	.....	.....	4.74	+ 1.7	9	.....	sw.	.....	.....	.....	12	7	12	4.4	
Narragansett	.....	10	.....	.....	.....	.....	67.6	— 0.8	83	1	72	54	7	63	22	64	63	88	7.87	+ 4.7	10	8,530	sw.	60	ne.	13	15	6	10	4.7	
New Haven	107	118	140	29.94	30.05	+ .08	70 1	— 0.1	88	3	78	52	*	63	25	.....	.....	.....	3.49	+ 0.3	9	.....	sw.	.....	.....	.....	19	2	10	.....	
Mid. Atlan. States.							72.0	+ 0.2	97	3	80	51	11	64	30	67	64	79	5.03	+ 0.1	9	5,646	s.	33	ne.	13	13	12	6	5.0	
Albany	97	84	113	29.94	30.04	+ .11	76.3	+ 1.7											4.29	0.0										5.2
Binghamton	875	79	90	.....	.....	.....	75.2	+ 2.8	100	3	86	50	11	65	32	66	61	65	1.07	— 2.9	9	5,038	s.	24	w.	15	9	18	4	5.1	
New York	314	298	326	29.73	30.05	+ .07	72.4	+ 3.7	95	3	84	40	12	61	39	.....	.....	.....	2.05	— 1.2	9	3,693	w.	20	sw.	19	8	11	12	6.2	
Harrisburg	377	94	104	.....	.....	.....	74.1	+ 0.6	99	3	81	57	13	67	29	67	64	77	4.76	+ 0.6	12	6,430	sw.	36	ne.	13	11	11	9	5.5	
Philadelphia	117	168	184	29.93	30.05	+ .06	77.4	+ 4.5	101	3	87	53	11	68	29	.....	.....	.....	5.07	+ 0.8	9	4,195	se.	22	nw.	30	11	11	9	5.2	
Atlantic City	52	68	76	30.00	30.05	+ .07	78.2	+ 2.5	100	3	87	57	13	69	29	69	65	72	3.63	— 0.5	8	6,341	sw.	36	nw.	4	7	12	12	6.0	
Cape May	24	52	70	30.04	30.06	.....	73.2	+ 1.3	94	1	78	58	12	69	24	70	68	86	2.23	— 1.2	8	6,983	sw.	50	ne.	13	11	14	6	4.9	
Baltimore	123	68	82	29.92	30.04	+ .06	73.0	— 0.6	88	1	76	62	11	69	19	69	.....	.....	4.13	+ 0.9	12	7,670	s.	36	nw.	13	11	11	9	4.6	
Washington	112	59	76	29.94	30.05	+ .06	78.7	+ 1.5	104	3	87	57	11	70	28	70	65	68	3.51	— 1.2	8	3,765	se.	20	ne.	12	14	10	7	4.4	
Cape Henry	.....	5	34	.....	.....	.....	78.8	+ 2.0	101	2	88	54	11	70	28	70	67	73	2.86	— 1.7	10	3,912	s.	32	nw.	19	11	14	6	4.7	
Lynchburg	685	83	88	29.35	30.07	+ .07	78.6	+ 1.6	99	4	85	65	6	72	25	.....	.....	.....	6.10	+ 0.5	15	.....	se.	.....	.....	.....	5	13	13	.....	
Norfolk	57	88	93	30.00	30.06	+ .05	77.4	— 0.1	99	2	86	57	12	68	30	70	68	78	7.17	+ 3.3	17	2,508	ne.	22	nw.	17	7	13	11	6.0	
Richmond	144	98	105	.....	.....	.....	78.8	+ 0.3	96	2	86	64	12	71	24	74	73	87	8.89	+ 3.0	18	5,384	sw.	29	ne.	19	11	12	8	4.8	
S. Atlantic States.							78.9	.....	99	2	87	58	11	70	25	.....	.....	.....	4.15	.....	17	4,426	n.	25	se.	17	6	17	8	5.6	
Charlotte	773	68	76	29.25	30.05	+ .02	80.0	+ 0.1										82	9.05	+ 1.7										5.8
Hatteras	11	17	36	30.06	30.07	+ .04	78.4	+ 0.2	97	2	87	58	13	70	25	70	68	78	4.82	— 0.7	20	4,514	e.	26	s.	4	4	19	8	5.9	
Kittyhawk	9	12	30	.....	.....	.....	78.6	+ 0.7	86	21	83	67	11	74	12	75	74	87	4.36	— 2.1	11	8,134	s.	34	nw.	19	12	14	5	4.8	
Raleigh	375	93	101	29.68	30.06	+ .02	79.1	+ 1.1	95	9	87	65	13	72	24	.....	.....	.....	5.54	— 0.3	12	9,825	.....	.....	.....	.....	15	8	8	5.4	
Wilmington	78	82	90	30.00	30.08	+ .05	79.5	+ 2.4	96	2	88	61	12	71	24	72	70	78	6.48	— 1.4	15	4,163	sw.	25	sw.	27	4	17	10	6.1	
Charleston	48	14	92	30.05	30.10	+ .06	79.0	— 0.7	95	19	86	62	12	72	22	74	73	86	7.03	— 0.2	19	5,284	sw.	24	ne.	11	6	14	11	6.4	
Columbia	.....	5	.....	.....	.....	.....	81.4	— 0.4	98	20	87	65	12	75	18	75	74	83	12.99	+ 5.4	17	7,394	sw.	38	ne.	11	5	16	10	6.3	
Augusta	180	89	103	29.87	30.05	+ .04	80.4	— 0.9	98	15	90	57	13	71	26	.....	.....	.....	12.17	+ 6.6	15	.....	sw.	.....	.....	.....	7	10	14	.....	
Savannah	82	63	89	29.99	30.07	+ .02	80.6	— 0.5	97	20	89	57	12	72	22	73	71	78	6.70	+ 1.4	12	4,281	sw.	29	se.	4	9	10	12	5.9	
Jacksonville	43	60	84	30.02	30.07	+ .02	81.2	— 0.7	99	21	89	63	12	74	21	75	73	82	8.53	+ 2.7	19	5,334	sw.	35	nw.	28	6	13	12	6.0	
Florida Peninsula.							82.0	— 0.1	98	18	91	67	28	73	26	75	73	84	12.03	+ 5.6	23	5,386	s.	36	s.	5	8	18	5	5.5	
Jupiter	28	13	30	30.05	30.08	— .02	81.7	— 0.3										79	5.79	— 0.3										4.4
Key West	22	43	50	30.05	30.07	+ .01	81.0	+ 0.2	91	22	87	69	2	75	17	76	74	81	6.80	+ 2.1	11	6,637	se.	36	ne.	2	13	14	4	4.5	
Tampa	36	60	67	30.03	30.07	+ .01	83.2	— 0.7	91	8	88	72	16	79	13	76	74	74	2.28	— 1.6	11	5,865	se.	22	e.	30	17	12	2	3.8	
East Gulf States.							81.0	— 0.4	95	20	89	68	11	72	22	74	72	82	8.29	— 1.5	20	4,443	e.	35	se.	12	9	17	5	5.0	
Atlanta	1,131	92	126	28.90	30.06	— .01	80.5	— 0.6										79	6.25	+ 0.3										5.4
Pensacola	56	78	90	29.98	30.04	— .01	78.0	— 0.4	96	1	86	58	12	70	22	71	69	82	10.22	+ 5.8	16	5,625	sw.	52	sw.	27	3	11	17	7.0	
Mobile	57	88	96	29.99	30.05	+ .01	80.9	+ 0.1	97	21	86	65	13	76	26	75	73	78	4.84	— 1.9	19	6,662	sw.	33	ne.	11	1	22	8	6.4	
Montgomery	221	100	112	29.81	30.04	— .00	81.0	— 0.2	97	21	88	66	13	74	23	74	72	79	5.60	— 0.9	14	4,984	n.	25	n.	3	18	13	0	3.4	
Vicksburg	247	65	73	29.76	30.02	— .03	80.6	— 0.9	100	1	89	61	13	72	26	73	70	78	5.26	+ 0.7	17	4,375	sw.	36	w.	21	2	20	9	6.3	
New Orleans	54	112	120	29.98	30.04	+ .01	79.6	— 1.7	94	22	88	64	11	72	26	74	72	83	5.90	+ 1.4	17	4,033	sw.	36	w.	1	13	12	6	4.4	
Port Eads	.....	27	.....	.....	.....	.....	81.4	— 0.8	97	22	88	70	3	75	19	74	71	76	4.57	— 1.9	14	5,381	s.	32	nw.	22	8	16	7	4.8	
West Gulf States.							81.6	— 0.7	98	25	87	71	*	76	17	.....	.....	.....	7.37	— 1.0	14	.....	s.	.....	.....	.....	1	19	11	.....	
Shreveport	249	77	84	29.75	30.01	— .01	81.6	— 0.3										75	2.14	— 0.2										4.7
Fort Smith	481	63	72	29.48	29.97	— .01	81.7	— 0.8	98	22	91	65	14	72	23	73	70	74	1.48	— 2.0	6	4,090	se.	28	se.	16	11	12	8	4.8	
Little Rock	302	71	79	29.71	30.02	+ .01	81.4	+ 1.4	99	28	91	60	12	72	27	73	69	71	2.31	— 2.1	9	3,845	e.	24	nw.	8	12	5	14	5.5	
Corpus Christi	20	42	50	29.98	30.00	— .02	80.1	— 0.2	97	21	89	64	11	71	27	72	69	74	2.60	— 1.4	7	4,873	s.	27	w.	31	9	11	11	5.7	
Galveston	42	85	96	29.95	30.00	— .03	81.6	— 0.1	94	13	87	72	12	76	22	77	75	82	0.43	— 0.9	6	9,301	se.	30	e.	13	19	12	0	3.2	
Palestine	510	54	61	29.47	30.00	— .03	82.4	— 1.5	91	22	87	72	16	78	13	76	73	75	3.62	+ 0.5	15	4,752	s.	22	sw.	18	9	15	7	4.9	
San Antonio	704	95	104	29.25	29.97	— .03	80.8	— 0.7	101	23	90	62	14	71	27	74	72	82	2.29	— 0.3	9	4,146	s.	30	se.	9	12	13	6	4.6	
Ohio Val. & Tenn.							83.0	— 0.3	103	23	93	66	12	73	29	72	67	68	2.24	0.0	8	6,140	se.	36	se.	1	17	8	6	4.2	
Chattanooga	762	106	112	29.29	30.07	+ .03	78.1	+ 1.3										71	4.01	0.0										5.0
Knoxville	1,004	10	88	29.03	30.06	+ .01	79.2	+ 1.4	97	1	87	59	13	71	29	71	68	77	6.48	+ 2.4	15	4,435	se.	35	nw.	30	8	15	8	5.3	
Memphis	399	140	154	29.62	30.03	+ .01	78.4	+ 2.0	98	2	88	59	13	69	28	70	68	78	2.97	— 1.4	15	4,838	sw.	34	nw.	30	7	15	9	5.4	
Nashville	545	128	134	29.46	30.03	+ .03	79.2	— 1.5	95	21	88	62	11	71	22	73	71	82	4.28	+ 0.8	13	5,702	sw.	42	se.	2	6	14	11	5.8	
Lexington	989	75	104	29.00	30.02	+ .01	79.0	— 0.3	96	2	87	62	11	71	26	71	67	71	4.50	+ 0.2	16	4,102	sw.	34	nw.	4	10	17	4	4.6	
Louisville	525	114	136	29.48	30.03	+ .03	76.2	+ 0.5	96	2	86	54	11	67	24	70	68	78	5.72	+ 1.0	16	5,466	sw.	44	sw.	28	11	9	11	5.7	
Evansville	434	72	82	.....	.....	.....	79.6	+ 1.2	97	2	89	58	12	70	26	69	65	66	2.15	— 1.6	7	5,034	s.	31	w.	25	9	11	11	5.7	
Indianapolis	823	154	164	29.18	30.03	+ .02	78.6	.....	96	23	87	57	11	70	26	.....	.....	.....	2.90	.....	15	4,669	s.	26	nw.	30	15	11	5	4.2	
Cincinnati	628	152	157	29.39	30.04	+ .04	76.9	+ 0.7	95	2	87	54	11	67	28	67	61	61	5.52	+ 1.3	7	5,866	ne.	38	sw.	3	12	13	6	4.5	
Columbus	824	87	100	29.17	30.02	+ .02	78.6	+ 1.2	98	3	88	58	11	69	27	69	64	65	3.26	— 0.1	9	4,616	sw.	39	nw.	25	14	12	5	4.2	
Pittsburg	842	116	123	29.18	30.05	+ .06	77.7	+ 2.8	100	3	88	52	11	67	30	68	64	70	2.33	— 0.9	9	4,769	sw.	32	w.	20	14	11	6	4.3	
Parkersburg	638	77	84	29.40	30.06	+ .02	77.2	+ 2.2	99	3	86	51	11	68	25	68	64	68	2.56	— 2.2	11	3,707	sw.	24	w.	25	6	15	10	5.9	
Lower Lake Region.							77.5	+ 4.0	100	3	88	51	11	67	30	69	65	70	4.38	0.0	12	3,365	se.	28	nw.	20	13	9	9	4.9	
Buffalo	769	178	206	29.22	30.02	+ .07	73.4	+ 2.2										67	2.66	— 0.4										4.2
Oswego	335	76	87	29.66	30.01	+ .05	73.0	+ 3.3	90	24	80	47	11	66	29	67	64	74	1.20	— 2.0	8	8,052	sw.	36	sw.	28	7	18	6	5.5	
Rochester	523	81	90	29.47	30.02	+ .07	71.6	+ 2.6	93	2	80	48	11	63	30	64	60	66	3.23	+ 0.1	8	5,743	s.	37	w.	25	16	12	3	3.7	
Erie	714	92	102	29.29	30.03	+ .06	74.0	+ 3.6	95	3	84	45	12	64	32	64	59	62	2.03	— 0.9	5	4,975	sw.	28	sw.	3	19	11	1	3.3	
Cleveland	762	190	201	29.24	30.03	+ .04	73.3	+ 2.3	89	2	80	54	12	66	21	66	62	69	1.63	— 1.1	8	6,362	sw.	27	n.	25	13	15	3	4.5	
Sandusky	629	62	74	29.37	30.03	+ .04	73.4	+ 1.9	95	2	80	53	11	66	24	66	61	67	2.19	— 1.3	10	8,894	n.	52	w.	20	19	12	0	2.7	
Toledo	674	122	127	29.33	30.03	+ .04	74.8	+ 1.7	97	2	83	53	11	67	25	67	63	68	5.49	+ 2.6	11	5,364	e.	36	nw.	19	7	16	8	5.7	
Detroit	730	160	166	29.27	30.03	+ .05	74.0	+ 0.6	95	2	84	49	11	64	27	66	61	65	3.30	+ 0.3	6	6,024	e.	36	sw.	19	11	16	4	4.4	
Upper Lake Region.							73.1	+ 1.5	94	2	83	49	11	64	24	65	60	66	2.03	— 1.3	6	4,640	sw.	38	w.	3	16	10	5	3.8	
Alpena	609	61	65	29.37	30.02	+ .07	68.6	+ 1.3										71	1.33	— 1.1										3.2
Grand Haven	638	55	64	29.36	30.02	+ .05	66.8	+ 1.5	93	2	76	42	11	57	31	61	58	73	0.82	— 2.1	2	6,013	nw.	28	se.	12	16	13	2	3.9	
Marquette	734	67	95	29.18	29.95	.00	70.2	+ 1.4	90	24	80	45	11	61	27	62	56	62	0.88	— 1.8	4	5,824	nw.	42	nw.	19	23	6	2	2.3	
Port Huron	639	70	108	29.36	30.03	+ .07	65.0	+ 0.1	93	17	75	45	5	55	34	60	56	75	2.57	— 0.4	14	6,960	nw.	52	sw.	19	7	13	11	5.9	
Sault Ste. Marie	634	58	65	29.33	29.99	+ .03	70.8	+ 2.3	95	17	81	47	10	61	35	64	60	73	1.44	— 1.0	8	6,169	ne.	36	w.	3	17	13	1	3.7	
Chicago	824	241	274	29.17	30.02	+ .04	68.9	+ 2.1	89	2	75	40	11	53	32	59	56	80	1.52	— 1.5	10	5,807	nw.	42	nw.	28	11	17	3	4.8	
Milwaukee	671	106	149	29.32	30.02	+ .04	73.4	+ 1.4	94	19	80	59	10	67	30	65	61	67	1.94	— 1.5	5	9,827	ne.	48	n.	19	22	9	0	2.3	
Green Bay	617	49	57	29.36	30.01	+ .03	71.2	+ 2.0	92	2	80	51	10	63	28	64	60	68	3.28	+ 0.2	4	5,699	e.	46	nw.	19	15	10	6	4.1	
Duluth	702	95	106	29.21	29.95	+ .03	70.6	+ 0.6	92	17	82	46	10	60	33	62	58	68	3.16	+ 0.2	10	4,800	s.	48	sw.	19	19	8	4	3.7	
North Dakota.							65.9	0.0	90	17	75	46	5	57	32	59	54	71	1.33	— 2.4	10	6,847	ne.	30	nw.	20	11	17	3	3.7	
Moorhead	935	54	60	28.94	29.92	+ .01	68.3	— 0.3										66	2.02	— 0.8										3.7
Bismarck	1,674	16	29	28.19	29.91	+ .01	67.8	+ 0.2	94	16	80	40	20	56	32	62	59	74	2.48	— 1.4	12	6,519	se.	34	se.	21	15	12	4	3.9	
Williston	1,875	15	31	27.97	29.90	+ .02	69.8	+ 0.3	97	26	82	38	20	57	38	60	53	60	1.64	— 0.8	6	6,910	nw.	34	nw.	19	15	12	4	4.0	
Upper Miss. Valley.							67.2	— 1.3	96	12	80	37	20	54	46	58	52	63	1.93	— 0.2	11	5,498	n.	42	sw.	25	23	7	1	3.2	
Minneapolis	.....	99	.....	.....	.....	.....	75.4	+ 0.2										67	3.26	— 0.4										3.7
St. Paul	887	114	124	29.09	29.96	+ .01	73.2	+ 1.6	92	17	83	54	31	63	28	.....	.....	.....	2.91	— 0.9	4	.....	s.	.....	.....	.....	12	14	5	.....	
La Crosse	720	70	78	.....	.....	.....	72.8	+ 1.3	91	17	83	54	10	62	30	63	57	62	1.94	— 1.4	6	5,177	se.	29	w.	19	13	14	4	3.9	
Davenport	599	71	79	29.37	29.99	.00	73.0	+ 0.1	94	24	84	50	10	62	32	..	.....	.....	1.75	— 2.3	8	4,204	s.	36	sw.	2	14	12	5	4.1	
Des Moines	867	84	88	29.12	30.02	+ .05	75.8	+ 0.8	97	24	86	58	30	66	30	66	62	64	1.85	— 1.8	7	4,578	sw.	38	nw.	27	20	8	3	3.4	
							74.2	— 0.3	97	19	85	54	30	64	32	65	60	66	1.86	— 1.7	7	3,623	s.	40	w.	19	22	8	1	2.6	

TABLE I.—*Climatological data for Weather Bureau Stations, July, 1898*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometers above ground.	Pressure, in inches: Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Up. Miss. Val.—Con																															
Dubuque	698	101	109	29.27	30.00	+ .03	74.1	— 0.2	95	19	85	53	30	63	34	66	61	66	2.83	— 1.4	7	4,225	s.	56	nw.	19	24	4	3	2.7	
Keokuk	614	64	78	29.37	30.01	+ .04	77.1	+ 0.2	97	24	86	56	11	68	28	68	63	65	3.06	— 1.0	5	4,321	ne.	38	w.	28	20	6	5	3.3	
Cairo	359	87	93	29.64	30.01	+ .02	78.4	— 0.5	94	2	86	62	12	71	32	72	70	80	5.67	+ 2.2	14	5,126	s.	38	n.	29	9	17	5	4.9	
Springfield, Ill.	644	82	92	29.35	30.02	+ .02	76.2	+ 0.2	96	24	86	54	11	66	28	67	62	64	2.34	— 0.4	7	4,845	s.	30	w.	29	11	17	3	4.2	
Hannibal	534	75	107	.....	.....	.....	76.2	— 0.5	96	24	85	53	11	68	26	....	....	....	4.20	+ 0.3	7	5,324	sw.	42	w.	29	23	4	4	2.9	
St. Louis	567	111	210	29.44	30.03	+ .04	78.2	— 0.6	96	24	86	57	11	70	23	70	66	70	7.44	+ 3.7	12	5,832	s.	35	w.	29	10	15	6	4.9	
Missouri Valley.							75.0	— 0.3										67	4.16	+ 0.1										4.0	
Columbia	.....	4	84	.....	.....	.....	76.3	+ 0.2	97	24	87	52	13	66	35	....	....	....	4.60	— 0.2	12	4,593	s.	34	nw.	29	14	8	9	4.7	
Kansas City	963	78	95	29.01	30.00	+ .03	77.3	— 0.2	96	19	86	61	30	68	29	69	65	70	4.93	+ 0.7	9	5,502	se.	50	nw.	27	17	10	4	3.8	
Springfield, Mo	1,324	100	103	28.64	30.00	+ .02	75.0	— 0.7	91	28	83	55	11	67	23	69	67	78	7.29	+ 2.5	11	6,140	se.	37	nw.	30	5	23	3	4.7	
Topeka	.....	81	....	.....	.....	.....	76.7	— 0.7	100	19	87	58	12	66	34	....	....	....	2.63	— 2.6	5	.....	e.	....	.....	...	9	21	1	....	
Lincoln	1,199	74	84	28.73	29.96	+ .01	74.7	— 2.1	97	27	86	54	30	63	38	66	61	67	3.93	0.0	7	7,174	se.	36	nw.	29	14	13	4	3.9	
Omaha	1,108	92	97	28.84	29.97	+ .02	75.3	— 0.9	95	18	85	59	30	66	28	66	61	65	4.20	— 0.6	7	5,399	se.	32	ne.	29	18	11	2	3.3	
Sioux City	1,139	96	164	.....	.....	.....	73.4	— 0.9	94	18	85	56	20	62	33	....	....	....	2.78	— 0.5	11	7,911	s.	36	s.	18	16	8	7	4.1	
Pierre	1,460	50	62	28.40	29.90	— .01	76.0	+ 1.4	102	21	89	51	20	63	36	63	55	55	3.05	+ 0.9	12	7,842	se.	46	e.	9	19	8	4	3.3	
Huron	1,306	56	67	28.57	29.93	— .01	71.0	+ 0.1	92	23	83	45	30	59	34	62	58	68	3.83	+ 0.7	14	8,812	s.	58	s.	5	11	17	3	4.5	
Yankton	1,234	52	58	.....	.....	.....	73.9	+ 0.3	96	26	85	52	30	63	36	....	....	....	4.35	+ 0.5	7	6,022	s.	36	s.	1	15	12	4	3.7	
Northern Slope.							69.0	— 0.6										51	1.51	— 0.2										3.7	
Havre	2,494	46	47	27.31	29.84	— .04	67.8	+ 0.3	98	16	81	44	20	55	39	56	47	55	2.57	+ 0.4	7	7,767	sw.	49	sw.	16	22	5	4	3.8	
Miles City	2,372	41	49	27.44	29.84	— .05	72.4	— 1.3	103	25	86	43	20	59	46	59	51	56	1.01	— 0.4	10	5,775	n.	45	n.	10	11	17	3	4.3	
Helena	4,108	88	93	25.88	29.96	+ .05	65.4	— 1.8	90	4	78	36	1	53	36	52	40	45	1.71	+ 0.6	7	5,920	sw.	39	sw.	17	21	8	2	3.0	
Rapid City	3,251	46	50	26.62	29.86	— .05	72.5	+ 1.2	99	5	86	50	2	60	38	58	45	46	1.50	— 0.2	10	5,753	w.	36	w.	8	13	11	7	4.3	
Cheyenne	6,105	58	60	24.12	29.88	— .01	66.3	— 0.6	93	26	80	40	3	52	42	53	38	46	1.83	0.0	10	7,245	s.	37	s.	20	14	14	3	4.0	
Lander	5,372	28	36	24.72	29.94	+ .02	66.1	— 0.9	91	25	82	40	2	50	43	52	38	45	0.67	— 0.1	7	3,548	sw.	30	sw.	20	19	11	1	2.8	
North Platte	2,826	43	52	27.09	29.93	.00	72.4	— 1.1	99	26	85	50	3	60	35	63	58	66	1.29	— 1.4	6	6,590	s.	31	s.	1	18	12	1	3.5	
Middle Slope.							76.1	— 0.4										62	2.77	— 0.1										3.7	
Denver	5,290	79	151	24.81	29.90	+ .03	72.4	+ 0.7	96	26	85	49	2	60	37	57	44	47	0.67	— 1.0	10	5,880	s.	45	nw.	20	11	18	2	4.4	
Pueblo	4,713	74	81	25.33	29.91	+ .02	74.3	+ 0.3	100	27	88	54	20	60	41	59	49	52	0.57	— 1.6	12	5,841	n.	36	n.	26	11	18	2	4.3	
Concordia	1,398	42	47	28.51	29.94	— .01	77.2	+ 0.1	106	27	89	53	14	65	33	67	61	62	2.87	— 0.3	5	4,665	s.	30	s.	1	13	15	3	4.5	
Dodge	2,504	44	52	27.41	29.92	+ .01	76.8	— 0.8	102	27	88	57	14	65	31	66	62	67	3.14	0.0	10	7,744	se.	44	s.	1	16	14	1	3.8	
Wichita	1,351	78	85	28.58	29.96	+ .02	77.4	— 1.0	100	29	88	57	14	67	31	69	64	68	5.30	+ 2.2	6	5,332	s.	40	sw.	29	18	10	3	3.5	
Oklahoma	1,218	54	62	28.72	29.97	+ .02	78.3	— 1.4	97	28	88	60	12	69	26	70	67	74	4.06	+ 0.2	7	6,403	s.	36	s.	19	24	6	1	1.9	
Southern Slope.							77.8	— 1.6										62	2.67	+ 0.8										3.6	
Abilene	1,749	45	54	28.18	29.94	— .02	81.3	— 1.4	102	23	92	62	14	71	28	68	62	60	1.46	— 0.2	7	6,597	s.	30	s.	19	14	15	2	4.0	
Amarillo	3,691	54	61	26.31	29.95	.00	74.2	— 1.8	95	28	85	56	17	63	32	64	58	64	3.88	+ 1.7	12	10,460	s.	54	n.	28	21	6	4	3.2	
Southern Plateau.							83.0	+ 0.1										41	0.80	— 0.4										3.5	
El Paso	3,767	10	110	26.19	29.88	+ .01	79.8	— 2.1	101	29	91	63	15	69	31	65	56	53	1.46	— 0.6	12	7,153	ne.	47	ne.	30	7	18	6	5.3	
Santa Fe	6,998	47	50	23.39	29.94	.00	68.2	— 0.3	89	28	79	49	16	57	28	55	46	55	2.31	— 0.5	13	4,269	se.	34	ne.	27	4	14	13	6.3	
Phenix	1,076	47	57	28.70	29.77	— .03	92.2	+ 2.3	111	25	104	73	4	80	32	70	58	37	0.24	— 0.6	2	3,473	nw.	32	n.	31	22	8	1	2.4	
Yuma	139	16	50	29.61	29.75	— .05	91.9	+ 0.4	113	13	105	73	6	79	34	72	62	43	0.00	— 0.1	0	5,789	w.	38	se.	29	23	7	1	2.0	
Independence	3,907	10	58	25.96	29.76	— .04	80.4	.....	105	29	94	49	1	67	34	55	25	17	T.	— 0.1	0	6,465	se.	30	nw.	30	23	8	0	1.5	
Middle Plateau.							72.5	+ 0.9										34	0.08	— 0.2										2.1	
Carson City	4,730	82	92	25.29	29.90	+ .05	69.5	+ 1.6	99	31	86	45	14	52	47	51	31	30	0.05	— 0.1	1	5,139	w.	35	w.	13	29	2	0	0.9	
Winnemucca	4,340	59	70	25.66	29.89	+ .04	72.2	+ 0.8	98	*	90	40	2	55	44	57	44	42	0.02	— 0.1	1	6,962	sw.	42	sw.	13	25	4	2	1.8	
Salt Lake City	4,344	83	90	25.65	29.88	+ .01	75.9	+ 0.4	97	28	89	49	2	63	36	57	40	30	0.18	— 0.4	4	4,334	se.	29	s.	10	19	9	3	3.5	
Northern Plateau.							69.6	+ 0.3										43	0.48	0.0										2.5	
Baker City	3,470	49	55	26.44	29.93	— .01	66.9	+ 0.9	98	11	83	42	23	51	42	51	37	41	0.33	— 0.3	6	4,032	s.	27	ne.	9	20	10	1	2.4	
Idaho Falls	4,742	10	56	25.26	29.91	+ .02	68.1	— 0.2	95	28	86	36	2	50	49	32	37	43	0.93	+ 0.5	3	8,602	s.	44	se.	11	23	6	2	2.5	
Spokane	1,943	99	107	27.93	29.92	.00	69.4	+ 0.4	98	11	84	46	6	55	40	54	40	43	0.43	— 0.3	4	4,588	sw.	30	sw.	12	21	4	6	2.8	
Walla Walla	1,018	65	73	28.88	29.92	— .02	74.0	0.0	101	11	89	48	6	59	41	60	50	46	0.22	— 0.1	4	4,183	s.	22	sw.	22	25	6	0	2.2	
N. Pac. Coast Reg.							62.0	+ 0.4										71	0.43	— 0.4										3.4	
Fort Canby	179	10	34	29.87	30.07	+ .01	58.1	— 0.4	77	29	63	48	7	53	22	55	54	93	0.67	— 0.5	9	6,598	n.	50	se.	16	9	9	13	5.9	
Port Angeles	29	47	62	.....	.....	.....	56.2	— 0.1	82	30	63	42	7	49	27	....	....	....	0.17	— 0.2	4	5,955	nw.	28	nw.	18	19	11	1	2.6	
Pysht	....	5	....	....	....	.....	60.0	+ 1.0	83	30	72	43	7	49	33	....	....	....	0.55	— 0.3	4	.....	w.	....	.....	...	21	2	8	....	
Seattle	119	114	121	29.91	30.04	— .02	64.6	+ 1.4	91	31	74	50	6	55	30	57	51	67	0.22	— 0.8	4	3,318	nw.	24	sw.	16	21	3	7	3.5	
Tacoma	213	113	120	.....	.....	.....	63.8	+ 1.8	91	31	74	48	7	53	32	....	....	....	0.26	— 0.5	1	4,269	n.	22	sw.	16	19	7	5	3.1	
Tatoosh Island ‡	86	7	21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Astoria	.....	18	....	.....	.....	.....	60.5	— 1.0	80	29	67	48	7	54	26	..	....	....	0.75	— 0.4	2	.....	n.	....	.....	...	14	6	11	....	
Portland, Oreg	153	203	213	29.86	30.02	— .01	66.4	+ 0.1	95	30	77	48	19	56	33	57	51	64	0.79	+ 0.2	2	5,721	nw.	28	w.	15	23	5	3	3.1	
Roseburg	521	56	67	29.44	29.99	— .05	66.4	+ 0.1	101	29	81	42	14	52	43	56	49	61	0.03	— 0.4	1	3,334	nw.	19	ne.	5	22	6	3	2.0	
Mid. Pac. C'st Reg.							64.1	— 0.4										62	T.	— 0.1										2.8	
Eureka	64	60	69	29.98	30.04	— .02	54.6	— 1.2	63	16	58	47	1	51	12	52	50	87	T.	— 0.1	0	4,749	nw.	32	nw.	17	10	7	14	6.0	
Red Bluff	334	54	58	29.50	29.84	— .02	83.1	+ 1.3	112	30	99	57	21	67	39	60	41	27	0.00	0.0	0	4,040	se.	24	n.	1	31	0	0	0.1	
Sacramento	71	106	117	29.78	29.85	— .04	74.2	+ 1.6	104	26	92	50	11	57	44	59	48	49	0.00	0.0	0	7,266	sw.	25	sw.	20	30	1	0	1.0	
San Francisco	153	161	167	29.80	29.96	.00	56.2	— 2.1	88	1	62	47	3	50	31	52	50	86	0.00	0.0	0	11,742	sw.	41	w.	15	16	14	1	4.0	
Point Reyes Light	.....	12	....	.....	.....	.....	52.4	— 1.4	75	1	57	45	3	48	27	....	....	....	0.00	0.3	0	.....	nw.	....	.....	...	15	6	10	....	
S. Pac. Coast Reg.							71.4	+ 0.7										62	0.02	0.0										2.0	
Fresno	332	67	70	29.45	29.79	— .07	83.9	+ 2.4	114	30	102	58	21	66	44	59	38	26	0.00	0.0	0	5,105	nw.	21	nw.	13	29	2	0	1.0	
Los Angeles	330	74	82	29.56	29.91	— .03	70.4	+ 1.1	91	14	82	56	9	59	34	61	58	75	0.07	0.0	1	3,325	w.	15	w.	30	12	19	0	3.1	
San Diego	87	94	102	29.82	29.92	— .03	66.7	— 0.4	77	12	71	60	10	62	14	62	60	82	0.00	0.0	0	4,659	nw.	24	nw.	7	30	1	0	2.0	
San Luis Obispo	201	10	46	29.74	29.96	.00	64.5	— 0.2	89	26	78	46	26	50	43	56	50	67	0.00	0.0	0	3,163	n.	18	n.	14	31	0	0	1.9	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters in the 1ines that denote number of days missing from the record. *Two or more dates. †Received too late to be considered in departures, etc. ‡Station moved to Neah, Wash., about 4 miles east of Tatoosh Island.

TABLE II.—*Meteorological record of voluntary and other cooperating observers, July, 1898.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco †	97	60	78.4	7.89	
Ashville *	100	59	79.0	6.81	
Bermuda †	102	63	79.3	7.89	
Birmingham †	99	60	81.0	5.77	
Bridgeport †	.....	.....	.....	5.53	
Citronelle †	94	66	80.0	5.31	
Cianton †	98	62	79.4	4.04	
Daphne	97	65	81.7	4.69	
Decatur †	102	59	80.4	5.24	
Demopolis	.....	.....	.....	8.72	
Elba	97	60	79.0	5.78	
Eufaula *a* †	102	59	81.1	11.27	
Evergreen	99	61	79.0	4.31	
Florence *a* †	.....	.....	.....	6.01	
Florence *b* †	99	63	80.3	5.52	
Fort Deposit	99	59	79.5	4.82	
Gadsden	100	59	79.1	5.49	
Goodwater	101	60	80.8	8.18	
Greensboro †	94	64	79.6	4.55	
Hamilton	103	56	80.7	4.02	
Healing Springs	95	58	78.6	6.71	
Highland Home †	95	61	78.8	5.40	
Jasper	.....	.....	.....	7.19	
Livingston	96	63	81.5	7.22	
Lock No. 4	98	60	80.0	5.60	
Madison Station †	101	57	78.2	6.64	
Maplegrove	98	60	79.2	6.34	
Marion †	97	62	81.0	4.84	
Mount Willing †	98	63	81.4	5.14	
Newbern †	98	66	81.0	8.36	
Newburg	102	55	80.6	6.83	
Newton †	95	58	77.2	5.15	
Oneonta	95	62	77.2	6.61	
Opelika †	101	63	80.1	6.39	
Oxanna †	94	56	76.1	5.19	
Pineapple	102	60	81.3	4.36	
Pushmataha †	100	61	82 0	6.06	
Riverton †	101	58	80.6	5.77	
Rockmills	100	54	79.2	4.96	
Scottsboro †	97	60	78.8	4.25	
Selma †	100	62	82.2	5.56	
Sturdevant	.....	.....	.....	4.62	
Talladega	97	58	79.8	8.33	
Tallassee	.....	.....	.....	7.23	
Thomasville *	99	63	80.8	6.36	
Tuscaloosa †	99	63	81.4	4.51	
Tuscumbia	99	63	80.7	3.95	
Union †	101	62	82.5	5.88	
Union Springs †	101	65	79 9	4.40	
Uniontown †	99	68	81.4	8.99	
Valleyhead	99	60	80.6	6.93	
Warrior	.....	.....	.....	5.25	
Wetumpka	101	62	81.3	7.74	
Wilsonville †	.....	.....	.....	6.29	
Arizona.					
Benson *1	101	74	84.4	2.67	
Bisbee †	94	60	74.9	8.86	
Buckeye †	110	72	90.2	0.90	
Camp Creek	105	68	84.6	1.25	
Casa Grande *1	111	88	97.7	0.30	
Champie Camp	116	72	91.8	0.90	
Congress	107	68	87.0	0.74	
Dragoon	.....	.....	.....	3.90	
Dragoon Summit *1	98	60	76.0	2.70	
Dudleyville	104	67	84.5	3.98	
Empire Ranch	96[b]	62[b]	78.2[b]	4.33	
Flagstaff †	99	48	70.9	3.70	
Fort Apache	101	50	74.8	4.33	
Fort Defiance	94	46	69.4	1.97	
Fort Grant †	97	57	76.4	2.65	
Fort Huachuca †	96	54	75.0	7.84	
Gilabend *a* *1	118	78	94.2	0.25	
Holbrook †	103	56	77.3	1.33	
Hot Springs	110	72	90.2	0.15	
Jerome	105	57	81.8	2.00	
Lochiel *1	95	65	74.6	5.12	
Maricopa *1	117	80	96.3	1.30	
Mesa †	113	65	90.0	0.95	
Mount Huachuca	94	53	74.2	7.08	
Music Mountain	115	59	88.4	0.28	
Natural Bridge	.....	.....	.....	4.32	
Oracle	100	57	78.3	3.72	
Oro	.....	.....	.....	2.38	
Oro Blanco	99	56	78.1	4.72	
Pantano *1	108	65	82.8	3.28	
Peoria †	113	76	93.4	0.19	
Phenix	109	71	89.4	0.20	
Pinal Ranch	.....	.....	.....	2.49	
Prescott	102	40	77.4	2.04	
San Carlos †	111	61	87.0	2.65	
San Simon *1	103	68	80.4	.....	
Showlow	.....	.....	.....	2.86	
Signal †	114	68	93.2	T.	
Snowflake	97	52	75.3	0.96	
Strawberry	96	50	72.4	2.10	
Sulphur Spring Valley	.....	.....	.....	4.43	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Texas Hill *1	120	84	98.7	0.06	
Tombstone	97	61	77.1	4.24	
Tucson *c* †	108	66	86.2	3.22	
White Hills	117	67°	92.4	0.40	
Willcox *1	100	62	79.6	3.13	
Arkansas.					
Amity	94	58	80.0	4.67	
Arkansas City †	.....	.....	.....	4.75	
Beebranch [g]	97	62	80.4	4.16	
Blanchard Springs †	99	58	80.2	2.39	
Brinkley	95	58	79.8	7.35	
Camden *a* †	.....	.....	.....	3.70	
Camden *b* †	99	62	81.0	3.69	
Canton *1	97	58	80.6	.....	
Conway	105	58	83.4	3.02	
Corning	96	51	78.5	6.44	
Dallas	97	56	79.9	6.98	
Dardanelle	.....	.....	.....	2.40	
Elon †	98	60	79.6	7.68	
Fayetteville †	96	50	76.0	7.11	
Forrest	97	58	80.1	2.76	
Fulton †	.....	.....	.....	1.87	
Hardy	96	55	78.8	4.71	
Helena *a* †	.....	.....	.....	1.68	
Helena *b*	101	66	82.2	1.99	
Hot Springs *a*	100	62	81.4	4.11	
Hot Springs *b*	.....	.....	.....	4.12	
Jonesboro	97	56	79.4	3.65	
Keesees Ferry †	94	51	78.0	6.00	
Lacrosse †	96	56	78.6	3.09	
Lonoke *1	100	60	81.6	3.87	
Lutherville *1	104	65	81.1	.....	
Malvern †	103	61	81.5	4.10	
Marianna *1	98	66	81.7	.....	
Marvell	98	61	80.8	6.67	
Mena *1	95	58	79.2	5.33	
Monticello	104	61	80.6	4.15	
Moore	.....	.....	.....	4.33	
Mossville	91	54	75.5	3.70	
Mount Nebo	87	59	75.6	6.00	
New Gascony	98	58	80.4	2.14	
Newport *a* †	.....	.....	.....	2.36	
Newport *b*	99	58	81.2	2.23	
Newport *c* †	99	53	79.6	2.56	
Oregon *1	90	50	76.0	.....	
Osceola	96	55	79.4	4.52	
Ozark †	100	60	81.5	2.87	
Picayune †	100	60	80.6	0.53	
Pinebluff †	100	64	82.6	1.76	
Pocahontas	93	57	78.8	6.42	
Pond	104	52	78.6	13.97	
Prescott	102	62	81.8	2.80	
Rison	99	60	78.6	3.37	
Russellville	97	59	81.4	5.41	
Silver Springs †	94	51	77.2	11.60	
Spielerville	101	55	80.9	3.36	
Stuttgart †	100	55	80.6	3.37	
Texarkana †	102	60	82.9	0.60	
Warren †	101	62	81.4	1.61	
Washington *†1	98	65	81.4	2.81	
Wiggs *1	98	60	80.6	7.00	
Winslow	88	55	74.6	3.46	
Witts Springs †	91	51	75.8	5.34	
California.					
Agnew	94	42	65.0	0.00	
Arlington Heights	108	52	75.5	0.00	
Azusa	.....	.....	.....	T.	
Ballast Point L. H	.....	.....	.....	0.00	
Bear Valley	.....	.....	.....	0.00	
Berkeley	94	50	61.6	0.00	
Bishop †	.....	.....	.....	T.	
Blue Lakes City	112	46	77.0	0.00	
Boca *1	98	36	61.0	0.00	
Bodie †	88	27	58.2	0.30	
Bowmans Dam	.....	.....	.....	0.00	
Caliente *1	104	67	81.4	0.00	
Campbell	96	41	65.0	0.00	
Cape Mendocino L. H	.....	.....	.....	0.00	
Cedarville †	99	39	70.1	T.	
Centerville *1	106	58	67.8	0.00	
Chico *1	114	65	85.2	0.00	
Cisco *1	85	46	58.7	0.00	
Claremont †	102	49	72.8	T.	
Corning *1	112	65	77.8	0.00	
Craftonville	110	59	81.2	0.00	
Crescent City †	68	39	54.8	0.33	
Crescent City L. H	.....	.....	.....	0.29	
Delano *1	114	70	88.2	0.00	
Delta *1	111	60	78.5	0.00	
Descanso	.....	.....	.....	0.15	
Drytown	111	46	77.0	T.	
Dunnigan *1	112	62	79.1	0.00	
Durham *1	102	58	81.8	0.00	
East Brother L. H	.....	.....	.....	0.00	
Edmanton *1	97	44	66.0	0.00	
Elsinore	114	52	79.4	0.00	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Escondido	104	48	73.6	0.00	
Fallbrook *1	100	58	70.8	T.	
Folsom City *1	109	62	80.4	0.00	
Fordyce Dam	.....	.....	.....	T.	
Fort Romie	93	39	64.1	0.00	
Fort Ross	88	45	56.6	0.00	
Georgetown	102	55	75.8	0.00	
Goshen *1	112	65	94.2	0.00	
Grand Island *5	108	51	79.9	0.00	
Grass Valley	.....	.....	.....	T.	
Greenville †	104	30	64.0	0.00	
Healdsburg *1	96	40	65.4	0.00	
Hill Ranch	116	46	76.6	0.00	
Hollister	98	40	64.2	0 00	
Humboldt L. H	.....	.....	.....	0.08	
Hydesville	78	42	59.2	0.00	
Indio *1	116	70	93.5	0.00	
Iowa Hill *1	101	61	74.6	T.	
Jackson	104	50	79.0	T.	
Keene *1	103	60	76.4	0.00	
Kennedy Gold Mine	106	47	77.1	0.00	
Kernville	.....	.....	.....	0.00	
King City * 1	104	50	69.1	0.00	
Kingsburg *1	110	70	93.2	0.00	
Kono Tayee	100	57	76.8	0.00	
Lagrange *5	114	57	84.9	0.00	
Laporte *†1	91	45	62.8	T.	
Lemoore *a* *1	110	61	86.3	0.00	
Lick Observatory	90	50	71.4	0.00	
Limekiln	114	55	83.5	.....	
Lime Point L. H	.....	.....	.....	0.00	
Lodi	105	50	75.8	0.00	
Los Gatos *b*	95	48	66.9	0.00	
Lytton Springs	102	49	70.8	0.00	
Malakoff Mine	100	48	72.7	T.	
Mammoth Tank *1	120	90	101.8	0.00	
Manzana	109	55	83.6	0.00	
Mare Island L. H	.....	.....	.....	0.00	
Merced *1	109	58	82.7	0.00	
Mills College	.....	.....	.....	0.00	
Milo	.....	.....	.....	0.00	
Modesto *1	105	60	83.8	0.00	
Mohave *1	115	64	87.8	0.00	
Mokelumne Hill *2	.....	51	77.2	T.	
Monterey *1	71	52	59.9	0.00	
Mountain View	.....	.....	.....	0.00	
Mount Tamalpais	95	44	70.0	0.00	
Napa *b*	106	45	67.3	0.00	
Needles	114	77	95.8	0.02	
Nevada City	98	44	70.0	0.00	
Newhall *1	108	60	76.2	0.00	
North Ontario	98	52	73.2	0.06	
North San Juan *1	100	56	78.0	0.00	
Oakland *a*	93	50	62.0	0.00	
Ogilby *1	122	90	100.4	0.00	
Oleta *1	102	55	78.9	T.	
Orland *1	116	62	89.9	0.00	
Palermo	114	52	80.6	0.00	
Paso Robles *b*	112	34	65.9	0.00	
Peachland *5	95	50	66.6	T.	
Piedras Blancas L. H	.....	.....	.....	0.00	
Pigeon Point L. H	.....	.....	.....	0.00	
Pilot Creek	.....	.....	.....	T.	
Pine Crest	94	50	68.1	0.00	
Placerville	106	54	75.1	T.	
Point Ano Nuevo L. H	.....	.....	.....	0.00	
Point Arena L. H	.....	.....	.....	0.00	
Point Bonita L. H	.....	.....	.....	0.00	
Point Conception L. H	.....	.....	.....	0.00	
Point Firmin L. H	.....	.....	.....	0.00	
Point Hueneme L. H	.....	.....	.....	0.14	
Point Lobos	84	48	55.1	0.00	
Point Loma L. H	.....	.....	.....	0.00	
Point Montara L. H	.....	.....	.....	0.00	
Point Pinos L. H	.....	.....	.....	0.00	
Point Reyes L. H	.....	.....	.....	0.00	
Point Sur L. H	.....	.....	.....	0.00	
Pomona (near)	103	51	74.1	0.00	
Poway *3	96	62	72.5	0.00	
Quincy †	97	36	65.2	0.13	
Redding *b* †	107	56	82.6	0.00	
Redlands	111	50	77.6	0.00	
Represa	102	56	77.8	0.00	
Rio Vista	106	52	74.7	0.00	
Roe Island L. H	.....	.....	.....	0.00	
Rosewood	115	49	79.7	0.00	
Sacramento *a*	102	50	74.6	0.00	
Salinas *1	76	50	63.3	0.00	
Salton *1	123	80	100.0	0.00	
San Bernardino †	107	49	76.0	0.00	
San Jacinto	110	48	78.6	0.22	
San Leandro *1	98	56	64.3	0.00	
San Luis L. H	.....	.....	.....	0.00	
San Mateo *1	95	58	67.8	0.00	
San Miguel *1	106	55	73.8	0.00	
San Miguel Island	74	48	60.1	0.14	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Santa Barbara *a*	78	54	65.0	T.	
Santa Barbara L. H	.....	.....	.....	0.00	
Santa Clara *a*	.....	.....	.....	0.00	
Santa Cruz *b*†	86	41	62.0	0.00	
Santa Cruz L. H	.....	.....	.....	0.00	
Santa Maria	85	44	65.8	0.00	
Santa Monica*[1]	88	58	71.5	0.00	
Santa Paula	87[a]	49[a]	65.9[a]	0.00	
Santa Rosa*[1]	96	50	60.5	0.00	
Saticoy	.....	.....	.....	T.	
Shasta	.....	.....	.....	0.00	
Sierra Madre	97	52	72.4	0.00	
Sneddens Ranch*[1]	96	28	63.5	0.00	
Sonoma	.....	.....	.....	0.00	
S. E. Farallone L. H	.....	.....	.....	0.00	
Stanford University	94	46	65.4	0.00	
Stockton *a*	104	.....	.....	0.00	
Summerdale†	95	47	69.6	0.00	
Susanville†	97	44	68.1	0.00	
Sutter Creek*[5]	100	44	72.2	0.00	
Tehama*[1]	111	65	87.0	0.00	
Templeton*[1]	113	58	75.2	0.00	
Trinidad L. H	.....	.....	.....	0.00	
Truckee*[1]	98	56	71.4	0.00	
Tuluare *b*	.....	.....	.....	T.	
Tulare *c*	112	54	83.4	0.00	
Turlock	105	64	84.4	0.00	
Ukiah	103	39	70.6	0.00	
Upperlake	108	48	75.4	0.00	
Upper Mattole*[1]	97	50	63.8	0.00	
Vacaville *a*[1]	111	58	76.9	0.00	
Ventura†	82	41	61.7	T.	
Visalia	114	52	81.4	T.	
Volcano Springs*[1]	124	90	102.2	0.00	
Walnut Creek	108	56	76.2	0.00	
Westpoint	.....	.....	.....	T.	
Wheatland	108	51	78.4	0.00	
Williams*[1]	109	63	83.8	0.00	
Wilmington*[5]	83	60	67.0	0.00	
Wire Bridge*[5]	105	58	79.9	0.00	
Yerba Buena L. H	.....	.....	.....	0.00	
Yreka†	105	41	70.8	0.02	
Yuba City*[5]	105	65	83.9	0.00	
Colorado.					
Altman	89	33	52.1	4.75	
Antlers†	98	47	74.4	0.88	
Arkins	.....	.....	.....	1.20	
Boulder	93	50	72.2	0.97	
Boxelder	.....	.....	.....	1.36	
Breckenridge†	82	30	55.8	2.19	
Canyon†	100	48	74.1	1.83	
Castlerock	98	43	70.8	4.20	
Cedaredge	95	41	72.4	1.27	
Cheyenne Wells	97	52	72.8	2.09	
Collbran	.....	.....	.....	T.	
Colorado Springs†	90	50	67.2	2.98	
Crook	104	46	74.5	2.62	
Delta	107	46	77.4	0.95	
Dumont†	.....	.....	.....	1.67	
Durango	93	43	69.2	3.46	
Fleming	.....	.....	.....	1.91	
Fort Collins†	97	44	69.0	0.50	
Fort Morgan	109	46	73.6	2.49	
Fox	.....	.....	.....	2.50	
Garnett	90	34	61.8	1.48	
Georgetown	83	44	62.6	.....	
Gleneyrie†	85	43	65.2	2.68	
Grand Junction†	99	57	79.6	T.	
Greeley	97	48	70.2	3.50	
Grover	.....	.....	.....	1.17	
Gunnison	88	34	64.8	1.93	
Hamps	95	44	67.5	1.84	
Hoehne	96	47	71.2	1.36	
Holly	.....	.....	.....	3.12	
Holyoke	.....	.....	.....	3.08	
Holyoke (near)	103	41	73.4	2.31	
Hugo	.....	.....	.....	2.90	
Husted†	95	43	67.6	2.81	
Lamar†	107	52	77.0	1.52	
Laporte	.....	.....	.....	0.67	
Las Animas†	101	50	75.0	2.90	
Leadville (near)*†[1]	76	49	58.8	1.31	
Leroy†	96	48	71.9	2.83	
Longs Peak	.....	.....	.....	2.94	
Loveland	.....	.....	.....	1.48	
Meeker	98	35	68.6	1.85	
Millbrook	95	38	64.4	4.64	
Minneapolis†	102	51	75.6	2.06	
Moraine†	85	35	60.6	2.19	
Pagoda†	96	33	65.7	1.48	
Paonia	.....	.....	.....	0.73	
Parachute	102	40	77.5	0.42	
Rangely†	99	42	73.0	0.38	
Redcliff	.....	.....	.....	4.00	
Rico	86	32	59.8	3.10	
Rockyford	99	53	74.2	3.52	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ruby	.....	.....	.....	0.08	
Saguache†	88	45	65.8	2.73	
Salida	92	40	66.4	2.96	
San Luis†	88	37	60.4	3.88	
Santa Clara*[1]	90	46	62.3	4.56	
Seguro	78	35	56.9	4.28	
Seibert†	.....	.....	.....	3.54	
Smoky Hill Mine	91	38	61.5	2.93	
Springfield	.....	.....	.....	2.37	
Stamford*[1]	78	40	51.9	4.71	
Steamboat Springs	91	29	60.5	0.00	
Strickler Tunnel	.....	.....	.....	4.41	
Trinidad	.....	.....	.....	2.37	
T. S. Ranch†	95	49	74.4	0.49	
Vilas	.....	.....	.....	1.43	
Wagon Wheel	81	30	53.7	2.00	
Walden	87	33	60.8	0.51	
Wallet	.....	.....	.....	0.55	
Wray†	101	53	74.4	1.88	
Yuma	.....	.....	.....	1.86	
Connecticut.					
Canton†	96	41	70.1	4.97	
Colchester	98	47	70.7	5.05	
Falls Village	.....	.....	.....	2.23	
Greenfield Hill	.....	.....	.....	5.91	
Hartford *b*	.....	.....	.....	4.49	
Hawleyville	97	42	72.4	2.84	
Middletown	103	46	74.1	5.24	
New London†	92	52	67.6	4.72	
Norwalk	98	45	71.4	7.27	
Pomfret	90	52	70.8	8.24	
Southington	96	44	71.6	3.33	
South Manchester	.....	.....	.....	5.78	
Storrs	96	45	69.8	6.24	
Voluntown†	95	44	70.0	5.73	
Wallingford	.....	.....	.....	4.96	
Waterbury	100	41	72.8	3.37	
West Cornwall†	92	46	69.6	1.79	
West Simsbury	.....	.....	.....	4.59	
Winsted*[1]	95	55	70.3	.....	
Delaware.					
Dover	99	55	76.8	2.92	
Milford	99	60	80.0	3.76	
Millsboro	98	59	76.5	6.99	
Newark	98	51	76.6	4.44	
Seaford	98	57	77.2	2.54	
District of Columbia.					
Distributing Reservoir*[5]	98	60	79.0	2.31	
Receiving Reservoir*[5]	97	61	77.9	2.49	
West Washington	102	52	78.6	2.74	
Florida.					
Archer†	100	59	81.0	18.18	
Bartow	100	67	82.0	9.32	
Boca Raton†	90	70	81.6	5.84	
Brooksville†	95	68	79.2	12.48	
Carrabelle†	95	66	82.0	3.10	
Clermont	102	68	83.8	7.44	
De Funiak Springs	99	60	78.6	9.83	
Earnestville	100	69	82.6	6.85	
Estero*[1]	91	73	79.8	6.84	
Eustis†	101	69	83.0	10.16	
Federal Point†	97	67	80.8	13.01	
Fort Meade	97	67	80.7	7.82	
Gainesville	100	69	83.4	12.71	
Grasmere†	99	70	83.6	5.35	
Haywood	.....	.....	.....	6.42	
Homeland	99	71	83.8	.....	
Huntington	100	68	82.0	5.44	
Kissimmee	96	70	83.2	7.90	
Lake Butler	100	69	82.8	14.04	
Lake City†	100	62	81.4	11.96	
Lakemont	100	63[c]	82.5[c]	12.32	
Lemon City	92	70	82.0	5.92	
Macclenny†	102[1]	67[1]	82.8[1]	15.79	
Manatee	96	65	80.4	13.93	
Merritts Island	92	70	81.8	6.12	
Myers†	94	68	81.0	8.16	
New Smyrna	92	67	78.9	3.94	
Ocala†	101	68	82.2	12.66	
Orange City	99	73	83.2	4.61	
Orange Park	100	66	83.2	7.95	
Orlando†	98	70	82.8	7.31	
Plant City	98	67	81.3	8.95	
St. Andrews	98	64	82.2	6.07	
St. Francis†	97	64	80.0	5.23	
St. Francis Barracks	93	68	79.8	9.00	
Sebastian	88	69	79.0	2.91	
Stephensville	94	.....	.....	21.90	
Switzerland	.....	.....	.....	9.99	
Tallahassee†	95	63	80.4	10.00	
Tarpon Springs†	93	70	80.5	12.77	
Wausau	97	63	81.6	4.23	
Georgia.					
Alapaha	98	61	80.6	13.21	
Albany†	100	62	82.8	7.12	
Allentown†	100	61	82.0	6.66	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Americus†	102	61	82.8	4.31	
Athens *b*†	99	58	78.9	5.43	
Bainbridge	101	63	81.0	6.76	
Bellville	100	53	80.6	6.93	
Blakely†	95	65	80.4	8.53	
Brag	101	59	79.4	14.64	
Camak	100	59	80.7	7.01	
Canton†	.....	.....	.....	6.70	
Clayton†	96	54	75.8	14.39	
Columbus	101	61	81.4	6.80	
Covington	96	58	77.7	10.20	
Crescent	98	62	78.5	12.58	
Dahlonega†	95	56	75.2	10.62	
Diamond	98	47	74.5	6.98	
Eastman	98	60	81.7	4.66	
Elberton†	100	59	79.3	7.72	
Fleming†	98	62	80.4	11.11	
Fort Gaines	98	62	81.5	8.27	
Franklin	94	62	78.4	11.76	
Gainesville	94	53	77.0	12.12	
Gillsville†	99	58	78.4	6.75	
Greenbush	96	59	76.9	9.91	
Griffin	100	59	79.8	7.41	
Hephzibah*[6]	96	60	81.0	10.40	
Jesup	100[m]	62	81.8[s]	8.15	
Lagrange†	99	59	80.0	4.76	
Leverett	104[c]	60[c]	80.8[c]	14.45	
Louisville	101	59	81.1	5.85	
Lumpkin	98	62	79.6	10.59	
Macon	102	61	81.2	6.15	
Marietta	93	57	76.2	13.19	
Marshallville†	95	65	80.3	6.84	
Mauzy	96	61	80.0	13.86	
Millen	104	60	82.6	11.76	
Morgan†	98	60	78.8	5.82	
Mount Vernon	97	61	82.0	9.50	
Newnan	99	58	78.5	7.37	
Point Peter	102	61	79.4	11.51	
Poulan†	97	61	79.6	8.36	
Quitman†	99	61	81.5	9.37	
Ramsey	98	59	78.2	6.79	
Rome†	97	60	79.2	7.54	
Talbotton†	98	59	77.9	11.58	
Tallapoosa	93	57	77.4	9.42	
Thomasville†	98	62	81.7	10.38	
Toccoa†	97	58	78.0	9.39	
Union Point	97	59	78.8	7.26	
Washington†	99	60	79.9	7.11	
Waycross	100	61	81.6	10.81	
Waynesboro	98	55	78.4	11.29	
West Point	97	58	81.2	4.88	
Idaho.					
Albany Falls	94	40	65.4	0.87	
American Falls	98	37	70.6	2.00	
Blackfoot†	97	37	70.0	1.10	
Boise Barracks	111	40	73.0	0.00	
Burnside†	91	36	66.0	1.53	
Coeur d' Alene	97	39	65.8	.....	
Corral*[1]	95	48	65.8	1.49	
Downey	96	29	66.4	0.63	
Fort Sherman†	101	40	68.0	1.12	
Gimlet†	92	32	64.8	1.52	
Gray	91	28	61.5	0.80	
Idaho City	99[d]	30[d]	65.0[d]	0.70	
Lake	86	30	57.0	0.35	
Lakeview	89	46	65.0	0.76	
Lewiston	100	55	77.6	0.41	
Lost River	92	35	65.5	1.82	
Marysville	92	28	64.3	1.80	
Minidoka	100	33	70.8	.....	
Moscow	95	34	64.4	0.79	
Murray†	95	38	63.6	1.23	
Nampa	105	41	73.8	T.	
Paris	94	30	63.8	0.25	
Payette	104	40	75.8	0.20	
Pollock†	101	41	70.4	0.13	
St. Maries	97	39	66.4	0.81	
Salubria	103	40	71.6	0.27	
Soldier†	96	30	64.2	1.09	
Swan Valley†	94	30	62.8	1.84	
Warren†	92	30	60.6	0.53	
Weston	93	35	67.3	0.72	
Yellow Jacket	.....	.....	.....	0.27	
Illinois.					
Albion†	96	53	77.8	5.51	
Alexander†	102	48	77.0	2.28	
Ashton*†[1]	96	62	75.4	1.60	
Atwood *a*[3]	100	44	73.0	2.99	
Atwood *b*	.....	.....	.....	3.47	
Aurora *a*	99	48	75.0	1.07	
Aurora *b*	98	47	74.6	1.13	
Bloomington†	98	46	76.8	4.40	
Cambridge	93	55	74.2	1.17	
Carlinville†	98	51	77.2	3.68	
Carlyle	.....	.....	.....	6.23	
Charleston	95	50	77.4	1.93	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Chemung	92	44	70.8	2.54	
Chester				6.34	
Cisne†	94	51	76.2	5.05	
Coatsburg	98	51	75.8	3.09	
Cobden†	94	53	76.8	7.35	
Danville	98	45[d]	75.0[d]	2.24	
Decatur†	99	46	76.6	1.07	
Dixon†	98	50	74.6	1.35	
Dwight†	99	45	74.8	0.29	
Effingham†	97	52	77.2	3.17	
Elgin	94	48	72.8	0.75	
Equality	97	58	79.5	3.60	
Fort Sheridan	94	48	72.6	1.65	
Friendgrove†				6.28	
Galva†	97	49	74.3	0.96	
Glenwood *[1]	93[j]	58[e]	73.4[b]	3.97	
Grafton†				5.68	
Grayville	98	57	79.8	2.94	
Greenville†	96	52	77.3	4.87	
Griggsville†	95	55	75.6	3.56	
Halfway				2.19	
Halliday *[4]	95	66	75.7	7.12	
Havana†	96	55	77.8	2.49	
Henry	100	45	75.8	1.10	
Hillsboro†	98	49	76.2	5.33	
Joliet†	97	48	74.4	1.59	
Kankakee *a*	100	48	76.1	1.69	
Kishwaukee	95	43	71.2	2.06	
Knoxville *a*	90	45	73.8	0.97	
Lagrange†	95	46	73.4	2.77	
Laharpe	96	51	75.4	2.35	
Lanark†	100	41	73.2	2.00	
Lexington	98	44	74.1	1.32	
Loami†				2.09	
McLeansboro†	97	54	77.8	3.57	
Martinsville	100[c]	48[c]	77.2[c]	1.15	
Martinton†	101	44	75.4	1.11	
Mascoutah *[3]	96	55	76.6	4.84	
Mattoon	100	46	76.6	1.66	
Minonk†	97	44	73.8	0.58	
Monmouth†	98	45	74.2	1.50	
Morrisonville†	95	50	74.4	2.74	
Mount Carmel†				3.57	
Mount Pulaski	101	52	78.2	0.56	
Mount Vernon	95	50	75.2	6.48	
New Burnside†	99	51	77.9	5.82	
Olney *a*	98	50	77.8	4.76	
Oswego *[1]	96	52	72.5	2.23	
Ottawa†	100	47	75.1	1.30	
Palestine†	97	51	77.0	2.80	
Pana	97	49	77.2	2.34	
Paris	98	49	77.2	1.67	
Peoria *a*†				0.58	
Peoria *b*†	98	50	77.4	0.47	
Philo†	96	48	75.0	1.98	
Plumhill†	93	52	75.8	6.02	
Rantoul†	99	49	75.8	1.87	
Reynolds	96	51	74.4	1.15	
Riley†	93	50	73.7	2.27	
Robinson	97	49	77.4	1.78	
Rockford	95	50	74.3	2.32	
Roundgrove†	99	49	75.8	1.68	
St. Charles *† [1]	95	53	73.0	1.74	
St. John†	96	56	78.0	7.52	
Scales Mound	97	44	71.8	3.75	
Streator†	97	55	76.4	0.62	
Sycamore†	95	44	72.2	1.22	
Tilden	95	51	76.4	6.91	
Tiskilwa †	96	51	74.8	1.17	
Tuscola†	97	44	75.6	3.78	
Walnut†	97	50	76.1	1.20	
Wheaton *[3]		56	72.2	1.90	
Winchester *[1]	96	54	74.2	3.30	
Winnebago†	93	48	72.6	2.74	
Indiana.					
Anderson†	95	47	75.5	3.46	
Angola	93	47	73.8	3.91	
Auburn *	99	44	74.3	4.67	
Bedford	101	45	74.8		
Bloomington†	97	52	77.8	2.69	
Bluffton†	98	42	75.0	3.57	
Boonville	100	55	79.1	3.27	
Bright	102	52	77.6	2.85	
Butlerville†	99	46	77.0	2.22	
Cambridge City†	97	42	74.8	2.07	
Columbia City *[1]	95	48	75.1	3.27	
Columbus†	97	44	75.7	2.04	
Connersville†	98	47	76.4	4.11	
Delphi†	98	45	75.4	2.93	
Edwardsville *† [1]	94	60	79.3	1.70	
Farmland†	94	47	74.4	4.07	
Fort Wayne	97	44	75.2	4.40	
Greensburg	96	52	76.2	1.85	
Hammond†	92	46	71.2	1.37	
Hector	98	46	76.8	4.33	
Huntington	96	54	76.3	3.80	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Jasper†	97	52	79.2	2.00	
Jeffersonville	97	53	78.5	3.39	
Knightstown†	99	47	77.2	4.25	
Kokomo†	93	49	75.4	2.65	
Lafayette†	95	47	75.4	1.87	
Laporte	97	49	78.1	2.01	
Logansport *b*†	96	50	76.3	1.94	
Madison	96	52	78.3	1.87	
Marengo†	97	48	77.8	1.24	
Marion†	99	44	76.2	2.10	
Markle	97	48	75.4	3.10	
Mauzy†	97	44	75.6	2.66	
Mount Vernon†	98	62	81.8	3.16	
Northfield †	93	44	74.3	4.62	
Paoli	98	46	78.0	1.91	
Princeton *[1]	99	56	76.7	2.25	
Richmond	96	44	75.1	4.61	
Rockport	98	58	78.6	3.33	
Rockville†	95	49	75.4	2.12	
Salem				0.85	
Scottsburg	97	51	78.9	1.57	
Seymour	96	54	77.5	3.95	
Shelbyville				3.82	
South Bend†	101	46	75.3	1.94	
Syracuse†				4.48	
Terre Haute†	96	54	78.4	1.40	
Topeka†	94	45	73.4	2.87	
Valparaiso†	96	50	73.2	3.00	
Vevay	98	60	80.6	5.55	
Vincennes	101	56	79.6	2.87	
Warsaw	95	47	74.0	2.46	
Washington†	97	53	78.4	2.07	
Winamac	102	42	75.9	3.44	
Worthington†	98	48	76.8	3.85	
Indian Territory.					
Healdton†	106	59	83.7	1.82	
Kemp	108	59	83.8	5.90	
Lehigh†	104	58	81.4	3.51	
Purcell	102[c]	60[c]	79.5[c]	5.86	
South McAlester†				1.32	
Tahlequah	98			3.68	
Tulsa†				7.95	
Wagoner	101	55	81.2	3.56	
Iowa.					
Adair				2.66	
Afton	101	53	75.4	2.67	
Albia	98[c]	52	74.0	4.66	
Algona *[1]	93	57	74.3	1.40	
Alta *a*†	93	53	72.8	2.32	
Amana†	96	47	74.3	2.66	
Ames *b*	100	42	73.4	1.10	
Ames (near)				0.32	
Atlantic†	98	47	71.8	2.60	
Audubon	98	48	72.8	4.34	
Belknap	96	56	75.2	3.30	
Belleplaine	100	45	71.8	2.30	
Bonaparte†	97	51	74.7	3.15	
Britt	97	48	71.2	1.27	
Carroll	95	48	73.3	2.61	
Cedarfalls	97	47	74.4	2.05	
Cedar Rapids†	100	52	75.4	1.90	
Centerville	97	54	75.0	3.63	
Chariton	93	52	73.0	6.94	
Charles City	94	48	71.9	2.98	
Clarinda†	102	61	80.2	4.49	
Clear Lake	92	51	71.6	5.14	
Clinton	99	48	75.0	1.89	
College Springs	96	52	74.3	8.28	
Corning†	98	53	73.7	2.31	
Council Bluffs	96[c]	57	76.3	3.68	
Cresco†	93	48	71.2	2.91	
Decorah†	94	46	72.0	3.04	
Delaware *[3]	96	51	72.0	1.45	
Desoto	99	52	74.4	2.46	
Dows	95	47	71.2	1.75	
Eldon	99	49	76.3	2.18	
Eldora	102	45	74.9	2.40	
Elkader†	97	45	72.6	3.55	
Estherville	98[c]	45[c]	71.0[c]	5.39	
Fairfield†	97	50	74.0	2.84	
Fayette†	93	45	71.4	4.36	
Forest City	90	51	71.0	2.14	
Fort Madison				2.63	
Fredericksburg				3.46	
Glenwood†	97	49	73.6	5.85	
Grand Meadow *[1]	90	56	70.1	4.02	
Greene	97	48	73.7	3.67	
Greenfield	96	51	73.6	2.63	
Grundy Center	97	46	70.2	1.32	
Guthrie Center	100	50	73.2	3.07	
Hampton	95	50	72.6	1.46	
Hawkeye				4.00	
Hedrick *[1]	98[j]	63[c]	77.7[f]	2.32	
Hopeville†	94	55	74.6	2.92	
Humboldt†	96	52	73.8	1.22	
Independence†	95	47	73.4	1.66	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Indianola †	95	53	73.8	2.86	
Iowa City *a*	99	49	75.1	2.27	
Iowa Falls†	96	44	72.0	1.73	
Keosauqua	97	52	76.0	3.07	
Knoxville	97	53	74.7	4.32	
Lamoni *c*	95	52	73.8	2.53	
Lansing	94	46	72.6	3.12	
Larchwood				3.39	
Larrabee†	98	47	70.8	5.06	
Leclaire				0.90	
Lemars	94	53	72.5	3.34	
Lenox	96	54	73.7	3.11	
Logan†	99	48	74.3	1.50	
Maple Valley				2.88	
Maquoketa	96	48	72.6	2.45	
Marshall†	96	49	73.6	2.67	
Mason City	92	50	72.4	3.02	
Millman				1.84	
Monticello	98	50	75.4	1.71	
Mooar	100	46	74.8	2.35	
Mountayr	95	54	73.8	3.69	
Mount Pleasant *[1]	92	63	76.1	2.49	
Mount Vernon *a* *[1]	95	58	75.5	3.20	
Mount Vernon *b*	98	52	74.2	3.18	
Neola	100	42	75.4	1.90	
New Hampton	91	47	71.7	3.05	
Newton†	97	52	74.6	1.43	
North McGregor				3.51	
Northwood	94	48	70.8	1.80	
Odebolt	100	50	74.3	5.05	
Ogden	99	50	73.0	1.69	
Olin	97	51	73.0	1.51	
Osage *[3]		57	71.0	2.85	
Osceola	94	52	73.4	4.77	
Oskaloosa†	99	48	74.0	3.44	
Ottumwa	98	52	74.2	3.52	
Ovid†	98	52	73.7	6.29	
Pella	92	52	70.8	2.89	
Pioneer	98	52	74.4	0.55	
Plover	97	50	74.2	3.30	
Primghar	95	48	73.1	4.52	
Red Oak	99	51	74.8	3.37	
Ridgway	94	52	73.1	3.64	
Rock Rapids	94	50	69.7	1.95	
Rockwell City	96	50	72.7	2.12	
Ruthven	96	50	74.2	3.74	
Sac City†	94	50	70.6	1.55	
Sibley	93	47	70.5	2.69	
Sidney	96	59	74.6	9.90	
Sigourney	102	51	75.8	3.86	
Spencer	95	50	71.6	4.09	
Spirit Lake†	98	51	73.6	3.46	
Stuart	96	55	74.4	4.15	
Tara	97	47	71.0	0.90	
Thurman	96	50	73.8	12.88	
Toledo	96	47	72.9	1.36	
Villisca	94	50	72.6	2.25	
Vinton *[1]	96	56[c]	73.6	0.85	
Wapello	98	50	75.1	1.29	
Washington	97	50	73.9	1.67	
Washta				3.04	
Waterloo	97	46	73.7	1.66	
Waverly	94	50	72.6	2.28	
Webster City	97	52	74.4	1.35	
Westbend *† [1]	96	54	71.4	2.93	
West Branch	98	44	73.7	1.14	
Whitten *[1]	96	52	74.0	1.38	
Wilton Junction †	98	47	74.6	2.98	
Winterset †	95	49	72.4	7.79	
Kansas.					
Abilene†	101	54	78.9	2.53	
Achilles				4.82	
Altoona *[3]	98	62	77.0	2.00	
Anthony				2.13	
Atchison †	96	56	75.8	3.09	
Augusta	100	50	78.4	4.27	
Baker	98	53	76.6	3.07	
Beloit†	106	54	77.0	2.32	
Burlington†	99	53	77.6	2.86	
Campbell	104	53	78.4	1.37	
Chanute	98[f]	56[f]	79.6[f]	1.08	
Colby†	104	47	74.2	1.35	
Columbus	94	52	77.4	6.20	
Coolidge†				2.16	
Cunningham†	107	49	79.0	3.45	
Delphos	107	53	79.5	0.98	
Dresden	98	52	75.7	3.65	
Ellinwood †	102	52	77.4	1.26	
Emporia	95	56	76.8	3.71	
Englewood †	105	51	78.0	6.07	
Eskridge	97	54	77.0	1.87	
Eureka				4.74	
Eureka Ranch†	105	47	77.8	0.82	
Fallriver	99	54	77.0	2.24	
Fanning				0.80	
Fort Riley †	97	57	78.9	3.08	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Scott†	98	56	78.4	2.43	
Frankfort	102	50	76.4	1.25	
Garden City	103	52	76.8	2.59	
Gibson	104	48	76.6	0.38	
Gove*[1]	100	58	79.9	1.27	
Grenola	97	52	77.1	6.21	
Halstead	102	52	77.4	2.40	
Hays	108	48	77.1	2.36	
Horton	99	56	76.3	2.62	
Hoxie	.....	46	.....	1.02	
Hutchinson	.....	.....	.....	3.20	
Independence	102	58	80.2	5.43	
Lawrence	98	58	78.0	1.35	
Lebanon	103	.....	.....	1.10	
Lebo†	97	56	77.3	4.81	
Macksville	102	47	75.4	2.10	
McPherson	104	53	78.4	2.53	
Manhattan *b*	100	56	77.9	2.48	
Manhattan *c*	98	52	76.4	2.47	
Marion†	103	55	80.6	2.43	
Meade†	110	53	79.6	4.73	
Medicine Lodge†	106	52	79.7	1.65	
Minneapolis†	106	52	80.2	1.52	
Morantown†	96	56	76.7	2.23	
Mounthope*[1]	102	65	78.9	2.73	
Ness City	104	62	80.2	2.18	
Newton	103	54	77.6	2.16	
Norton	.....	.....	.....	4.98	
Norwich	.....	.....	.....	3.63	
Oberlin	.....	.....	.....	5.30	
Olathe†	96	54	76.9	5.93	
Osage City†	100	54	77.6	2.02	
Oswego	98	54	77.6	6.80	
Ottawa	97	50	75.3	3.46	
Phillipsburg	.....	.....	.....	3.44	
Pratt	.....	.....	.....	5.10	
Rome*†[1]	101	55	77.0	2.52	
Russell	108	50	78.6	1.37	
Salina†	105	53	79.9	2.61	
Sedan†	97	54	78.8	5.83	
Toronto	101	50	77.2	2.27	
Ulysses	.....	.....	.....	2.87	
Viroqua†	105	52	77.6	2.82	
Wallace	.....	.....	.....	3.47	
Wamego*[1]	98	60	78.0	3.15	
Wellington	.....	.....	.....	4.32	
Yates Center	99	52	77.2	3.78	
Kentucky.					
Alpha [2]	.....	.....	78.3	7.83	
Ashland	100	51	78.8	.....	
Bardstown†	98	54	78.6	5.85	
Blandville†	94	57	77.6	7.88	
Bowling Green *b*†	99	60	79.2	2.19	
Burnside†	.....	.....	.....	5.27	
Caddo	98	54	78.0	3.38	
Canton*[1]	97	60	77.3	7.14	
Carlisle	96	50	77.3	6.05	
Carrollton	.....	.....	.....	1.68	
Catlettsburg	.....	.....	.....	4.84	
Earlington	99	52	79.0	4.17	
Edmonton†	92	56	76.2	3.15	
Ensor	99	54	78.0	2.98	
Eubank	94	50	75.4	4.16	
Falmouth†	.....	.....	.....	5.76	
Fords Ferry	97	54	77.7	5.46	
Frankfort	94[m]	52[m]	77.0[m]	3.86	
Georgetown	96	56	78.0	.....	
Greensburg†	101	49	78.2	4.94	
Henderson†	98	57	79.7	2.81	
Hopkinsville†	97	57	78.8	4.00	
Irvington	96	52	77.7	0.44	
Leitchfield†	95	55	76.9	4.35	
Loretto	97	48	77.1	5.20	
Maysville	102	48	78.2	6.40	
Middlesboro†	99	53	76.3	6.97	
Mount Hermon	95	56	77.1	3.69	
Mount Sterling†	96	55	77.7	4.05	
Owensboro†	97	55	77.3	1.94	
Owenton†	.....	54	.....	3.88	
Paducah *a*†	.....	.....	.....	4.00	
Paducah *b*†	100	60	81.1	3.83	
Princeton	99	56	78.6	4.91	
Richmond†	97	53	77.5	7.28	
Russellville†	102	51	79.8	2.47	
St. John†	93	53	75.8	2.31	
Sandyhook	98[n]	52	76.4	7.96	
Scott	96	49	77.8	2.02	
Shelby City	102	51	77.6	6.36	
Shelbyville†	100	51	79.2	2.32	
Vanceburg	96	49	74.4	12.10	
Williamsburg†	102	50	77.6	7.76	
Woodburn	.....	.....	.....	2.18	
Louisiana.					
Abbeville	95	67	80.9	4.84	
Alexandria†	101	59	80.8	3.67	
Amite†	97	64	81.5	7.64	
Bastrop†	99	60	81.2	7.22	
Baton Rouge†	97	65	81.3	10.76	
Calhoun	97	62	80.4	3.81	
Cheneyville†	99	63	81.3	6.44	
Clinton†	93	64	79.6	11.99	
Como	96	62	80.4	7.41	
Covington	98	61	81.2	7.13	
Donaldsonville	96	67	82.0	5.80	
Emilie	97	62	79.8	8.14	
Farmerville	95	62	79.7	9.04	
Franklin†	95[b]	73[b]	85.1[b]	6.38	
Grand Coteau	98	65	81.8	7.39	
Jeanerette	102	64	81.7	4.84	
Jennings	99	59	79.2	5.18	
Lafayette	98	63	81.8	5.28	
Lake Charles†	100	67	82.4	5.05	
Lake Providence	95	.....	.....	7.63	
Lawrence	96	60	81.0	7.82	
Liberty Hill	103	62	81.8	3.21	
Mansfield	98	59	80.2	4.30	
Melville	97	63	83.1	7.74	
Minden	101	61	81.5	3.94	
Monroe†	98	63	82.0	6.90	
Montgomery	100	63	82.2	5.52	
New Iberia	95	66	81.6	3.75	
Oakridge	100	62	81.4	6.39	
Opelousas	97	62	80.5	3.66	
Oxford	97[d]	58[c]	79.9[d]	4.30	
Paincourtville†	100	64	82.2	3.62	
Plain Dealing†	98	58	80.7	2.94	
Plaquemine	96	66	81.4	4.58	
Rayne [g]	100	65	81.5	3.99	
Robeline	99	55	78.3	4.44	
Ruston	97	61	78.2	3.94	
Schriever	99[d]	64	81.4	6.46	
Shellbeach	96	69	82.7	6.05	
Southern University†	94	63	78.4	10.05	
Sugar Ex. Station†	96	67	81.6	6.19	
Sugartown	97	65	81.3	5.90	
Venice†	91	70	80.6	8.46	
Wallace	98	60	81.1	9.68	
White Sulphur Springs	100	62	80.3	5.97	
Maine.					
Bar Harbor	96	45	66.4	1.70	
Belfast*[6]	89	56	66.8	1.38	
Calais	94	44	66.6	1.14	
Cornish*[1]	93	53	70.3	1.46	
Cumberland Mills	100	48	70.7	1.24	
Fairfield	94	47	69.8	1.13	
Farmington	96	40	68.9	2.80	
Flagstaff	91	30	64.4	1.05	
Gardiner	101	49	71.6	0.98	
Kineo	91	49	69.6	0.90	
Lewiston	98	50	71.1	2.35	
Mayfield*[1]	94	43	67.4	1.52	
North Bridgton	96	42	70.2	5.42	
Orono	99	39	68.6	2.44	
Petit Menan*[1]	75	53	61.0	.....	
Winslow	96	42	69.8	1.95	
Maryland.					
Annapolis	95	58	78.6	3.17	
Bachmans Valley	103	46	76.8	4.62	
Boettcherville	109	40	76.8	2.15	
Charlotte Hall†	102	49	78.1	4.27	
Cherryfields†[3]	..	...	.....	77.5	7.64
Chestertown	97	54	77.6	3.05	
Collegepark	105	48	79.2	2.11	
Cumberland *b*	103	55	80.4	1.50	
Darlington†	98	53	76.4	6.27	
Deerpark	94	32	69.0	3.76	
Denton	102[c]	60[c]	78.6[c]	5.75	
Easton†	101	54	78.4	2.26	
Ellicott City	101	51	77.1	3.73	
Fallston	95	52	75.5	3.33	
Frederick	104	52	79.4	1.64	
Frostburg	.....	41	.....	4.24	
Grantsville	94	37	69.8	7.77	
Greatfalls	100	48[l]	77.2[c]	2.48	
Greenspring Furnace	104	47	78.7	3.42	
Hancock	103	46	77.8	3.48	
Jewell†	99	53	76.7	3.57	
Johns Hopkins Hospital	104	55	78.4	2.61	
Kensington	102	50	78.4	2.42	
Laurel	104	52	78.1	1.72	
Mardela Springs†	98	52	75.6	3.91	
Mount St. Marys Coll. †	102	55	77.6	3.17	
New Market	105	53[l]	79.7[c]	2.41	
Pocomoke City	101	59	79.4	4.74	
Port Deposit	100	51	77.8	3.60	
Princess Anne	95	54	69.8	2.12	
Sharpsburg	102	48	77.2	4.21	
Solomons†	99	62	79.0	4.69	
Sunnyside	93	33	69.0	5.56	
Taneytown†	103	48	77.9	6.30	
Van Bibber	97	53	77.2	3.37	
Westernport	107	42	77.0	4.54	
Woodstock	102	51	78.1	3.15	
Massachusetts.					
Adams	98	35	70.5	.....	
Amherst	95	42	71.5	2.65	
Attleboro	.....	.....	.....	8.25	
Bedford	95	49	70.1	4.96	
Bluehill (summit)	97	51	69.7	7.41	
Cambridge *a*	99	51	72.3	4.25	
Chestnut Hill	98	51	72.2	5.57	
Cohasset	.....	.....	.....	6.98	
Concord	97	45	70.3	5.80	
Dudley[1]	99[e]	48	71.0	5.87	
East Templeton*[1]	94	52	70.3	2.18	
Fallriver	94	56	71.2	5.55	
Fiskdale	.....	.....	.....	6.97	
Fitchburg *a*[1]	93	54	71.4	2.84	
Fitchburg *b*	96	42	71.6	3.23	
Framingham	100	48	72.8	3.98	
Groton	95	41	69.7	3.05	
Hyannis*†[1]	88	56	70.0	3.85	
Jefferson	.....	.....	.....	3.00	
Lawrence	97	50	72.2	2.74	
Leeds	97	39	71.2	3.37	
Leicester Hill	95	46	70.8	2.12	
Leominster	.....	.....	.....	3.03	
Long Plain	.....	.....	.....	6.54	
Lowell *a*	96	49	72.9	2.93	
Lowell *b*	97	46	71.4	.....	
Ludlow	95	39	68.7	4.67	
Mansfield*[1]	99	50	70.1	9.36	
Middleboro	96	46	70.0	7.78	
Monson	96	43	70.8	6.14	
New Bedford *a*	93	54	69.9	6.04	
New Bedford *b*	94	49	69.2	5.74	
New Salem	92	47	70.0	1.95	
Pittsfield	95	43	70.7	2.87	
Princeton	.....	.....	.....	2.68	
Provincetown	89	54	70.6	6.26	
Somerset*[1]	100	54	75.2	5.78	
South Clinton	.....	.....	.....	3.57	
Springfield Armory	97	42	70.2	4.54	
Sterling	.....	.....	.....	2.78	
Taunton *b*	97	46	70.2	9.52	
Taunton *c*	97	46	70.2	9.89	
Turners Falls	95	43	71.4	2.46	
Webster	.....	.....	.....	6.02	
Westboro†	96	46	72.8	4.00	
Weston	95	48	70.5	5.33	
Williamstown	90	41	69.0	1.48	
Winchendon	.....	.....	.....	2.04	
Worcester *a*	90	37	69.7	3.20	
Michigan.					
Adrian	96	45	73.6	3.98	
Agricultural College	96	40	70.0	1.34	
Allegan	96	40	72.6	0.72	
Alma	97	37	71.0	0.98	
Ann Arbor	98	44	74.0	1.45	
Arbela	95	39	71.8	1.57	
Badaxe	96	36	71.0	0.87	
Baldwin	96	25	69.8	3.12	
Ball Mountain	95	42	71.4	1.46	
Baraga	95	36	67.4	3.42	
Battlecreek	100	42	74.8	0.91	
Bay City *b*	94	42	70.2	1.38	
Berlin	95	38	69.7	0.88	
Berrien Springs	98	42	76.2	1.85	
Big Rapids	93	32	67.3	3.29	
Birmingham	99	48	74.0	1.86	
Boon	94	28[c]	66.0	1.43	
Calumet	90	41	65.3	2.60	
Camden	99	42	73.5	3.04	
Carsonville	94	40	70.4	1.32	
Charlevoix	93	45	69.8	1.03	
Cheboygan	94	37	68.7	2.59	
Clinton	101	41	74.1	1.77	
Coldwater	96	42	72.4	2.60	
Crisps*[10]	90	39	64.9	.....	
East Tawas	89	41	68.6	0.62	
Eloise	98	45	73.1	2.06	
Escanaba†	86	41	67.6	2.09	
Ewen	92	30	69.1	1.04	
Fairview	94	44	71.9	2.41	
Fitchburg	99	32	70.9	0.15	
Flint	96	39	70.7	1.60	
Gladwin	95	34	68.7	1.80	
Grand Rapids *b*	102	42	73.8	0.54	
Grape	97	44	74.1	3.26	
Grayling	98	28	69.2	0.35	
Hammonds Bay*[10]	88	50	67.6	.....	
Hanover	98	41	73.1	2.48	
Harrisville	93	40	68.6	0.48	
Hart	95	35	71.8	1.65	
Hastings	98	36	72.1	0.40	
Hayes	92	35	67.5	1.01	
Highland Station	.....	.....	.....	1.65	
Hillsdale	94	41	71.8	2.91	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Holland *10	86	50	71.2	.....	
Howell	96	46	73.8	0.27	
Humboldt	90	31	63.4	0.76	
Ionia	99	40	71.1	0.40	
Iron River	89	38	62.9	2.98	
Ivan	96	32	70.2	0.39	
Jackson	99	42	73.0	1.54	
Jeddo	94	41	69.6	1.40	
Kalamazoo	98	44	74.4	0.53	
Lake City	94	34	68.9	0.50	
Lansing	96	42	71.7	1.36	
Lapeer	95	39	70.2	0.94	
Lathrop	92	34	64.4	2.91	
Ludington	86	42	69.0	0.67	
Luzerne	94	29	67.2	1.00	
Mackinaw City	92	38	66.2	0.92	
Madison	97	46	74.4	2.35	
Mancelona	93	31	68.0	1.05	
Manistee	90	38	67.7	0.98	
Manistique	84	37	63.1	0.86	
Middle Island *10	92	53	68.5	.....	
Midland	98	40	69.5	1.21	
Mottville	101	40	73.1	3.11	
Mount Clemens	98	43	72.2	2.21	
Mount Pleasant *b*	.....	39	.....	1.39	
Muskallongee Lake *10	90	38	63.2	.....	
Muskegon	92	48	71.4	1.25	
Newberry	91	28	63.0	2.11	
North Manitou Island *10	89	39	70.8	.....	
North Marshall	97	37	73.0	0.73	
Northport	91	41	68.0	0.55	
Old Mission	95	45	70.8	0.75	
Olivet	95	44	71.8	1.67	
Omer	93	29	68.2	1.05	
Ottawa Point *10	88	44	69.9	.....	
Ovid	99	42	72.2	2.02	
Owosso	100	41	73.8	1.80	
Parkville	.....	.....	.....	1.73	
Pentwater *10	86	52	70.9	.....	
Petoskey	91*	37	65.9	1.76	
Plymouth	97	40	72.4	2.09	
Pointe aux Barques *10	92	46	70.3	.....	
Point Betsey *10	81	52	69.0	.....	
Port Austin	92	37	68.3	.....	
Powers	93	34	67.6	2.15	
Reed City	96	29	67.5	.....	
Rockland	90	43	67.2	.....	
Rogers	94	38	68.0	0.45	
Saginaw	98	40	73.1	2.21	
St. Ignace	96	34	66.1	4.55	
St. Johns	97	42	73.3	1.54	
St. Joseph	97	50	73.5	1.74	
Sandbeach *a*	92	36	69.4	0.20	
Sidnaw	90	34	66.5	.....	
Somerset	96	40	72.2	2.74	
South Haven	92	44*	71.2	0.58	
Sturgeon Point *10	92	40	68.4	.....	
Thomaston	93	30	70.0	1.28	
Thornville	94	42	72.0	1.24	
Traverse City	95	38	68.0	0.94	
Two Heart River *10	90	34	63.3	.....	
Valley Center	96	33	66.1	0.60	
Vandalia	98	42	74.2	1.75	
Vassar	96	36	70.6	2.30	
Vermillion Point *10	86	34	58.7	.....	
Wasepi	95	42	72.2	2.36	
Waverly	95	38	70.6	1.14	
West Harrisville	90*	39	66.6*	0.29	
Wetmore	91	30	64.0	2.32	
White Cloud	97	35	74.3	1.24	
Williamston	98	40	71.8	1.74	
Ypsilanti	93	41	71.7	1.46	
Minnesota.					
Ada†	.....	.....	.....	3.44	
Albert Lea	91	51	70.2	1.96	
Alexandria†	94	45	70.4	4.01	
Beardsley	90	42	68.2	9.40	
Bingham Lake	98	46	73.2	.....	
Bird Island	96	45	72.0	1.17	
Blooming Prairie†	93	47	70.0	1.20	
Caledonia†	95	46	72.0	2.14	
Camden	94	44	70.7	2.74	
Campbell	92	40	67.4	4.99	
Collegeville	91	.....	.....	2.08	
Crookston†	90	41	67.2	3.31	
Deephaven	.....	.....	.....	2.40	
Detroit City	92	41	66.6	5.92	
Faribault	92	42	71.6	1.21	
Farmington†	96	42	68.8	1.02	
Fergus Falls†	92	43	69.6	6.58	
Glencoe	90	41	68.2	1.23	
Grand Meadow†	96	44	72.2	2.07	
Granite Falls	95	45	70.3	2.53	
Koochicking	91	38	65.2	5.78	
Lake City	98	46	73.3	2.48	
Lake Jennie	92	50	72.6	1.76	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lakeside†	92	45	70.8	0.17	
Lake Winnibigoshish	90	42	66.6	3.88	
Leech Lake	93	42	68.1	5.37	
Long Prairie	92	41	69.2	4.78	
Lutsen	81	43	60.0	4.35	
Luverne†	94	50	71.2	1.79	
Lynd	93	45	69.6	2.69	
Mapleplain	92	51	71.5	3.18	
Milaca	93	43	69.0	2.63	
Milan†	95	45	70.6	4.19	
Minneapolis *a*	92	48	71.5	0.51	
Minneapolis *b*†	93*	46	71.0	3.24	
Minnesota City †	.....	.....	.....	2.39	
Montevideo	96	47	70.3	2.88	
Morris	94	46	70.9	5.88	
Mount Iron	90	38	65.0	5.88	
Newfolden	92	38	67.2	7.15	
New London	96	48	72.4	4.97	
New Richland *1	91	54	72.1	.....	
New Ulm†	92	40	71.8	0.54	
Park Rapids†	91	41	66.4	5.67	
Pine River	88	45	67.2	5.09	
Pipestone	.....	.....	.....	1.42	
Pleasant Mounds	91	49	70.5	1.53	
Pokegama Falls	89	40	65.5	5.40	
Redwing	.....	.....	.....	3.01	
Reeds	.....	.....	.....	3.00	
Rolling Green	91	51	70.6	1.60	
St. Charles†	95	50	72.0	1.65	
St. Cloud	96	48	70.3	1.83	
St. Olaf	91	43	69.0	2.22	
St. Peter	91	.....	.....	0.50	
Sandy Lake Dam	89	41	66.3	2.80	
Sauk Center	92	42	71.0	3.52	
Shakopee	91	52	74.1	1.25	
Slayton	92	40	68.6	0.60	
Tower†	96	.....	.....	6.00	
Two Harbors	92	42	64.4	1.37	
Wabasha *1	101	54	72.6	1.24	
Willmar	94	48	70.3	2.47	
Willow River	94	39	68.0	5.30	
Winnebago City	93	51	72.2	1.57	
Worthington	91	50	69.8	1.05	
Zumbrota [1]	93*	44	72.5	.....	
Mississippi.					
Aberdeen	101	57	80.2	3.73	
Agricultural College	94	62	80.4	4.32	
Austin†	97	61	80.2	3.66	
Batesville†	94	60	79.2	3.49	
Bay St. Louis	99	69	81.4	4.85	
Biloxi†	97	66	81.0	7.00	
Booneville	97	59	80.1	3.39	
Briers	93	64	79.2	5.24	
Brookhaven†	101	63	82.0	6.30	
Canton†	96	62	79.4	6.07	
Columbus *a*	.....	.....	.....	5.98	
Columbus *b*	104	59	82.8	4.39	
Corinth	97	60	79.9	6.94	
Crystal Springs†	93	62	78.8	6.26	
Edwards	97	65	81.5	4.59	
Fayette	97	62	80.4	2.50	
French Camps	97	53	77.3	9.42	
Greenville *a*	93	66	79.7	1.69	
Greenville *b*†	97	65	80.6	1.57	
Greenwood	93	64	80.6	8.14	
Hattiesburg†	98	65	81.7	6.14	
Hazlehurst	97	63	80.0	5.65	
Hernando	98	60	80.8	2.13	
Holly Springs†	96	60	79.4	6.54	
Jackson†	95	62	80.0	9.40	
Lake†	92	59	78.2	11.17	
Leakesville	100	60	81.3	8.36	
Logtown†	95	64	80.6	7.45	
Louisville†	95	56	78.9	8.66	
Macon†	100	60	82.6	2.53	
Magnolia†	93	62	78.9	7.01	
Meridian	99	61	81.0	2.83	
Moss Point	96	70	82.4	6.70	
Natchez†	98	65	81.2	5.30	
Okolona†	101	59	81.7	3.07	
Palo Alto	95	63	81.0	3.78	
Pontotoc	95	58	79.0	7.62	
Port Gibson†	97	61	80.5	5.12	
Rosedale *	95	62	81.0	.....	
Stonington *1	90	66	78.1	.....	
Thornton	94	74	84.0	8.46	
Tupelo†	.....	.....	.....	4.39	
Walnut Grove	.....	.....	.....	12.91	
Water Valley *†1	96	62	77.1	5.40	
Windham	100	60	81.0	8.34	
Woodville†	95	65	79.8	8.62	
Yazoo City†	100	62	81.4	7.74	
Missouri.					
Akron	.....	.....	.....	2.85	
Appleton City	99	56	78.8	8.44	
Arthur *3	.....	63	76.8	3.66	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Avalon	95	57	75.0	3.92	
Bethany	95	52	75.2	4.88	
Birchtree	92	52	74.6	5.46	
Bolckow	.....	.....	.....	4.93	
Boonville†	.....	.....	.....	3.65	
Brunswick	94	58	75.8	3.06	
Carrollton†	95	58	76.4	4.13	
Conception	92	60	74.8	10.27	
Cowgill *b	98	60	77.4	5.53	
Darksville	95	54	75.6	5.60	
Downing	.....	.....	.....	4.09	
East Lynne *3	98	56	72.6	5.51	
Edgehill *b	90	52	74.0	15.06	
Eightmile *1	92	57	73.6	5.68	
Eldon	101	47	79.8	3.91	
Elmira	97d	50d	75.4e	3.73	
Fairport	.....	.....	.....	6.50	
Farmersville	.....	.....	.....	4.44	
Fayette	99	57	79.8	3.87	
Fulton	.....	.....	.....	6.75	
Gallatin *1	97	57	76.6	5.69	
Glasgow	97	53	76.2	3.83	
Gordonville *3	.....	63	74.5	3.57	
Gorin	.....	.....	.....	6.15	
Halfway	95	50	76.0	7.59	
Harrisonville†	96	53	76.7	6.27	
Hermann†	.....	.....	.....	6.66	
Houston	95	47	76.2	3.94	
Houstonia	.....	.....	.....	5.43	
Irena	.....	.....	.....	4.14	
Ironton†	94	47	74.8	9.14	
Jefferson City†	100	55	77.8	3.97	
Kidder	96	56	74.3	4.91	
Lamar†	96	55	78.1	4.42	
Lamonte	.....	.....	.....	4.75	
Lebanon	92	54	75.5	5.64	
Lexington	97	55	77.0	5.40	
Liberty	96	53	75.6	5.40	
Louisiana	96	50	76.6	4.66	
McCune *†1	93	58	76.2	6.43	
Malden *d*	93	60	79.5	1.15	
Marblehill	97	48	75.4	5.28	
Marshall†	95	54	75.3	2.63	
Maryville	96	50	74.5	7.78	
Mexico†	99	52	77.2	4.04	
Miami	.....	.....	.....	3.82	
Mineralspring	92	49	74.2	12.07	
Montreal	94	47	74.8	4.69	
Mount Vernon	96	52	78.9	6.24	
Neosho	94	47	76.6	9.17	
Nevada	94	53	75.6	3.01	
New Haven	95	56	77.0	6.64	
New Madrid	96	56	78.8	7.00	
New Palestine	95	56	76.8	2.49	
Oakfield	95	55	77.0	6.77	
Olden†	92	51	74.8	3.06	
Oregon *a*	96	56	75.4	4.45	
Oregon *b*	95	58	77.2	4.62	
Osceola†	.....	.....	.....	6.45	
Oto	.....	.....	.....	8.05	
Palmyra *5	96	62	78.4	4.25	
Phillipsburg *†1	94	60	75.2	6.13	
Pickering *3	.....	53	70.8	10.28	
Platte River	96	54	74.8	3.63	
Potosi	93	42	69.6	7.70	
Princeton	104	53	76.8	3.49	
Rhineland	96	50	75.4	6.95	
Richmond	95	57	76.0	4.31	
Rolla	.....	.....	.....	6.34	
St. Charles	96	54	76.8	6.99	
St. Joseph	.....	.....	.....	3.08	
Sarcoxie *3	99	56	76.4	4.90	
Sedalia	95	53	75.4	5.25	
Seymour	91	49	74.4	5.73	
Shelbina	.....	.....	.....	7.10	
Sikeston	98	50	78.0	5.87	
Steffenville	95	53	75.3	6.96	
Stellada†	96	53	76.2	3.90	
Sublett	96	50	75.2	3.96	
Unionville	99	55	78.8	1.97	
Vichy	97	46	75.2	6.94	
Warrenton	96	50	75.9	7.65	
Wheatland	.....	.....	.....	6.22	
Willow Springs	100	50	75.7	7.71	
Zeitonia	96	50	76.8	4.67	
Montana.					
Adel	85	32	57.5	2.84	
Billings	95	43	71.7	1.41	
Boulder	90	35	61.6	0.54	
Bozeman†	90	37	64.2	0.84	
Butte	90	33	63.4	0.54	
Castle	85	31	58.0	1.98	
Chinook†	96	38	68.1	1.79	
Columbia Falls	95	36	65.0	1.82	
Crow Agency	97	42	69.4	1.69	
Dearborn Canyon	92	35	63.2	1.76	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dupuyer	95	38	64.4	.....	
Fort Benton	92	43	67.2	0.80	
Fort Keogh †	104	43	72.7	0.90	
Fort Logan	87	37	63.0	1.76	
Glasgow	101	41	69.0	1.58	
Glendive †	103	44	73.0	0.40	
Glenwood	92	33	63.8	1.34	
Greatfalls †	97	45	67.1	2.30	
Kalispell	95	50	70.0	1.15	
Kipp †	93	34	60.5	1.03	
Livingston †	90	40	65.5	1.23	
Manhattan †	91	34	64.7	0.63	
Martinsdale †	94	36	63.8	1.76	
Marysville †	86	34	61.3	2.86	
Missoula	.....	41	.....	0.76	
Parrot	93	39	66.2	0.73	
Poplar	103	42	70.2	1.34	
Radersburg	.....	.....	.....	0.40	
St. Pauls †	93	40	65.2	1.92	
Troy	100	37	65.2	1.00	
Utica	93	33	62.9	3.16	
Wibaux	98	32	65.2	0.60	
Yale	92	35	61.8	3.32	
Nebraska.					
Agee *1	99	56	73.5	3.05	
Albion	93	48	71.9	1.11	
Alliance	.....	.....	.....	4.76	
Alma *1	98	56	74.9	2.09	
Ansley †	98	41	72.8	1.42	
Arapaho *1	98	59	76.4	1.85	
Arborville *1	100	54	74.6	0.46	
Ashland *a* †	98	52	76.4	1.18	
Ashland *b* *1	104	63	78.2	1.66	
Ashton	98	50	74.8	0.88	
Auburn *† 1	102	54	75.0	2.70	
Aurora	.....	.....	.....	0.69	
Bassett	.....	.....	.....	4.12	
Beatrice †	.....	.....	.....	2.38	
Beaver City †	101	50	75.2	1.60	
Bellevue	.....	.....	.....	3.25	
Benedict	.....	.....	.....	0.30	
Benkelman	.....	.....	.....	2.85	
Blair	96	51	73.9	1.38	
Bluehill	.....	.....	.....	0.87	
Brokenbow	.....	.....	.....	2.03	
Burchard	.....	.....	.....	1.95	
Burwell	.....	.....	.....	2.33	
Callaway †	100	49	76.2	2.60	
Camp Clarke	104	42	72.0	2.13	
Central City *5	102	60	80.2	0.40	
Cody	.....	.....	.....	2.90	
Columbus †	95	42	72.0	0.82	
Creighton †	99	47	73.8	2.96	
Crete	99	51	75.0	1.84	
Culbertson	.....	.....	.....	1.44	
Curtis *a*	101	52	74.7	2.56	
David City	95	49	74.4	0.70	
Dawson	99	52	75.0	2.30	
Divide	.....	.....	.....	1.06	
Eden	.....	.....	.....	3.24	
Edgar *1	100	58	79.4	0.79	
Elba	.....	.....	.....	1.10	
Ericson *† 1	98	61	79.6	1.91	
Ewing †	.....	.....	.....	3.30	
Fairbury †	102	42	75.2	0.80	
Fairfield	.....	.....	.....	0.60	
Fairmont †	102	50	74.2	T.	
Fort Robinson	99	41	71.8	2.19	
Fremont †	95	51	74.6	2.56	
Geneva †	104	41	74.6	0.35	
Genoa	99	52	75.3	1.36	
Gering	.....	35	.....	1.65	
Gordon	.....	.....	.....	2.26	
Gothenburg	106	45	75.3	1.48	
Grand Island *a*	.....	.....	.....	1.60	
Grand Island *b*	98	50	73.8	1.39	
Greeley	.....	.....	.....	0.90	
Haigler	.....	.....	.....	1.20	
Hartington †	96	50	73.4	3.84	
Harvard	98	51	74.4	0.77	
Hastings *1	98	57	75.0	0.55	
Hayes Center	.....	.....	.....	1.85	
Hay Springs	97	46	70.9	2.74	
Hebron †	103	52	76.5	0.71	
Hickman	.....	.....	.....	1.25	
Holdrege *b*	.....	.....	.....	1.85	
Hooper *1	94	58	73.9	0.64	
Imperial †	101	45	75.7	3.37	
Johnstown	.....	.....	.....	4.19	
Kearney	.....	.....	.....	1.76	
Kennedy	97	40	72.5	3.70	
Kimball †	101	45	71.7	2.26	
Kirkwood *1	98	57	72.4	4.31	
Lexington †	97	41	71.6	1.29	
Lincoln *b*	96	53	74.9	2.38	
Lincoln *d* †	99	52	75.9	2.62	
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lodgepole †	101	39	71.2	1.60	
Loup *b* *1	98	54	73.9	1.93	
Lynch *† 1	95	54	72.5	4.85	
Lyons	.....	.....	.....	0.46	
McCook	.....	.....	.....	1.68	
McCool	.....	.....	.....	0.25	
Madison	95	50	72.9	0.90	
Madrid *5	104	55	76.4	0.63	
Marquette	.....	.....	.....	0.62	
Merriman	.....	.....	.....	0.80	
Minden *a*	98	50	74.6	1.50	
Minden *b*	.....	.....	.....	1.47	
Monroe	.....	.....	.....	1.25	
Nebraska City *c*	102	53	73.9	2.65	
Nemaha *1	101	55	77.4	4.56	
Nesbit	100	45	71.6	2.25	
Norfolk *b*	95	.....	.....	1.60	
Norman	.....	.....	.....	2.35	
North Loup	99	49	74.5	0.99	
Oakdale †	99	50	74.4	2.15	
Odell *5	98	58	76.8	1.08	
O'Neill †	95	48	69.9	3.87	
Ord	104[k]	49[k]	75.2[k]	0.91	
Osceola	.....	.....	.....	0.40	
Ough †	.....	.....	.....	1.28	
Palmer *b*	.....	.....	.....	0.97	
Plattsmouth *a*	.....	.....	.....	11.53	
Ravenna *a*	96	46	74.2	2.19	
Ravenna *b*	.....	.....	.....	1.59	
Redcloud *a*	.....	.....	.....	1.13	
Redcloud *b* *1	102	60	78.3	1.63	
Republican *1	100	56	79.7	1.80	
Rulo *1	100	60	77.6	3.22	
St. Libory	94	52	75.6	1.49	
St. Paul	98	54	76.8	1.38	
Salem *1	96	60	75.9	2.13	
Santee Agency †	105	52	76.0	6.16	
Sargent	.....	.....	.....	1.83	
Schuyler	.....	.....	.....	0.27	
Seneca *1	96	47	70.8	5.00	
Seward *1	98	60	75.4	0.92	
Springview	101	48	74.9	2.14	
Stanton	95	50	74.2	1.32	
State Farm	.....	.....	.....	6.60	
Stockham	.....	.....	.....	0.80	
Strang *1	97	58	77.2	0.80	
Stratton	.....	.....	.....	2.52	
Superior *5	96	60	76.4	1.15	
Syracuse	.....	.....	.....	2.83	
Tablerock	99	54	78.6	2.35	
Tecumseh *b* †	104	32	77.8	1.45	
Tekamah	98	51	73.9	1.99	
Thedford *1	98	54	70.4	5.50	
Turlington †	101	55	76.8	3.09	
Valentine †	100	42	73.4	2.28	
Valparaiso	.....	.....	.....	T.	
Wakefield	97	50	72.8	2.08	
Wauneta	.....	.....	.....	2.81	
Weeping Water *1	95	50	71.0	2.92	
Westpoint †	99	50	75.2	0.80	
Whitman	.....	.....	.....	2.00	
Wilber *1	97	50	74.6	1.55	
Willard	.....	.....	.....	1.60	
Wilsonville *1	100	58	78.1	1.92	
Wymore *1	96	60	74.3	1.78	
York *1	104	58	76.6	0.28	
Nevada.					
Austin	93	38	70.9	0.40	
Battle Mountain *1	102	60	74.5	0.00	
Beowawe *1	100	58	77.2	T.	
Blaine	91	30	64.0	0.21	
Candelaria	99	44	75.8	T.	
Carlin *1	102	50	71.5	0.00	
Carson City	99	40	68.0	0.07	
Clover Valley	.....	.....	.....	0.12	
Elko *1	100	52	69.6	0.00	
Elko (near)	103	34	68.4	T.	
Ely	98	36	70.1	0.50	
Empire Ranch	104	45	79.9	0.01	
Fenelon *1	108	48	69.9	T.	
Golconda *1	98	56	76.7	0.00	
Halleck *1	106	49	72.6	0.20	
Hawthorne *a* *1	96	57	80.4	0.20	
Hawthorne *b*	101	51	76.6	0.20	
Hot Springs	.....	.....	.....	0.00	
Humboldt *1	99	57	75.6	0.00	
Lewers Ranch	98	38	68.0	0.01	
Los Vegas	103	57	78.5	0.05	
Lovelocks *1	102	58	76.3	0.00	
McGill	104	37	69.2	0.37	
Martins	94	39	66.7	0.00	
Midas	98	48	72.6	0.28	
Monitor Mill	98	34	68.7	0.14	
Osceola	96	54	75.7	0.38	
Palisade *1	98	52	70.6	0.00	
Palmetto	99	38	68.8	0.49	
Nevada—Cont'd.	°	°	°	*Ins.*	*Ins.*
Panaca	109	44	76.4	0.96	
Reno *1	104	56	77.0	T.	
Reno State University	99	44	70.2	0.00	
Ruby Valley	.....	.....	.....	0.26	
St. Clair	100	45	72.9	0.00	
St. Thomas	114	60	88.6	0.00	
Silverpeak	107	51	80.7	T.	
Sodaville	105	48	79.0	0.12	
Spring Valley	104	49	75.6	T.	
Tecoma *1	108	40	75.3	0.00	
Toano *1	98	50	74.0	0.20	
Tuscarora *1	.....	.....	.....	0.22	
Tybo	103	.....	.....	0.00	
Verdi *1	106	40	70.6	0.00	
Wadsworth *1	106	50	78.4	0.00	
Wells	99	36	70.3	0.18	
New Hampshire.					
Alstead *6	90	45	73.4	2.16	
Berlin Mills	94	32	68.4	4.28	
Bethlehem	90	38	68.4	2.55	
Brookline *1	98	50	72.5	2.77	
Claremont	98	39	71.8	0.81	
Concord	96	38	71.0	1.31	
Durham	98	48	70.8	1.76	
Hanover	96	39	70.4	1.20	
Keene	96	37	70.4	1.25	
Lancaster	.....	.....	.....	2.05	
Littleton	91	39	69.1	1.98	
Nashua	100	43	71.3	5.04	
Newton	97	41	69.2	1.68	
Peterboro	92	35	69.4	1.61	
Plymouth	98	35	71.5	2.31	
Sanbornton †	93	38	68.8	2.97	
Stratford	93	32	68.0	2.46	
Warner	.....	.....	.....	1.93	
New Jersey.					
Asbury Park	102	57	74.0	11.72	
Bayonne	103	53	76.2	4.28	
Belvidere	101	45	75.2	4.69	
Bergen Point	100	57	75.4	5.25	
Beverly †	104	51	77.9	2.95	
Billingsport *1	97	62	77.4	3.89	
Boonton	101	47	74.6	4.09	
Bridgeton	102	53	78.8	5.34	
Camden	96	54	76.1	4.78	
Cape May C. H. †	95	56	74.6	3.59	
Charlotteburg	99	38	70.6	4.50	
Chester	96	46	73.0	4.21	
Clayton	102	50	76.8	2.95	
College Farm †	103	48	76.0	3.91	
Deckertown	99	42	73.2	3.79	
Dover	102	44	74.0	3.71	
Egg Harbor City	101	49	76.0	5.82	
Elizabeth †	105	52	76.2	4.17	
Englewood	102	44	74.7	5.66	
Flemington	104	46	76.4	6.27	
Franklin Furnace	96	42	72.7	5.61	
Freehold	96	50	74.4	7.07	
Friesburg	102	53	77.2	3.58	
Gillette	100	47	73.4	6.15	
Hammonton	.....	.....	.....	4.80	
Hanover	96	45	72.8	3.94	
Hightstown	101	51	76.8	4.87	
Imlaystown	104	50	78.1	5.51	
Junction	.....	.....	.....	4.88	
Lambertville	102	49	78.0	3.06	
Moorestown	100	51	76.8	4.01	
Newark *b* †	102	56	76.2	3.85	
New Brunswick *a*	105	50	77.8	5.42	
Newton	99	42	73.6	4.39	
Ocean City	94	55	73.6	5.28	
Oceanic	99	58	73.8	6.70	
Paterson	102	51	75.5	3.70	
Plainfield	101	47	74.8	5.42	
Rancocas	.....	.....	.....	4.38	
Rivervale	105	42	74.4	4.78	
Roseland	98	43	73.4	4.44	
Salem	103	50	78.0	5.24	
Somerville	107	47	76.6	6.57	
South Orange	100	51	74.4	5.26	
Staffordville	.....	.....	.....	9.47	
Toms River	102	45	74.0	8.75	
Trenton	100	56	78.5	3.19	
Tuckerton	98	52	75.4	3.59	
Vineland	104	51	76.8	5.42	
Woodbine	97	52	74.0	6.16	
New Mexico.					
Albert	101	57	76.4	4.52	
Albuquerque †	100	56	78.0	1.25	
Alma	100	56	73.5	4.00	
Aztec †	99	51	74.0	2.47	
Bernalillo †	98	62	78.4	0.90	
Bluewater	100	41	70.8	3.72	
Buckmans	87	38	61.4	4.12	
Clayton	100	50	72.6	2.44	
Deming *1	105	60	78.2	1.66	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Mexico—Cont'd.	°	°	°	*Ins.*	*Ins.*
East Lasvegas†	88	48	68.3	4.63	
Eddy	100	60	77.8	4.35	
Engle†	101	57	76.2	3.65	
Espanola	98	51	73.0	2.22	
Folsom	92	49	69.6	3.48	
Fort Bayard	96	50	71.4	6.56	
Fort Union	93	40	67.2	5.74	
Fort Wingate	99	50	72.2	3.83	
Galisteo	98	46	73.5	3.41	
Gallinas Spring†	100	52	75.2	4.00	
Gila	103	59	78.6	3.18	
Laluz	94	54	75.0	6.30	
Las Cruces†	102	52	75.8	2.18	
Las Vegas Hotsprings	93	42	67.8	5.90	
Lordsburg*[1]	99	64	80.4	2.33	
Lower Penasco	98	52	72.4	7.20	
Puerto de Luna	102	55	76.6	5.41	
Raton	92	44	68.0	4.00	
Rincon†	102	62	77.6	3.62	
Roswell†	100	58	76.3	6.53	
San Marcial	97	55	75.8	1.62	
Shattucks Ranch	100			4.00	
White Oaks†	95	47	69.4	5.60	
Winsors Ranch	86	37	60.4	5.10	
New York.					
Addison	95	38	71.8	2.16	
Akron				3.15	
Alden	92	37	72.0	0.80	
Alfred	90	35	70.2	2.55	
Angelica†	91	36	70.4	1.79	
Appleton	94	41	71.3	1.05	
Arcade	89	35	70.2	2.98	
Atlanta				3.83	
Auburn	95	43	74.2	1.32	
Avon	93	37	73.5	2.09	
Baldwinsville	98	43	73.6	1.59	
Bedford	99	42	71.2	4.88	
Big Sandy*[10]	92	42	72.8		
Bouckville	90	40	70.4	2.63	
Boyds Corners				4.78	
Brentwood	102	42	72.9	7.40	
Canajoharie[1]	92*	58	74.8	2.69	
Canton	95	34	71.0	1.96	
Carmel	97	52	74.0	3.80	
Carvers Falls	96	39	71.2	1.73	
Catskill	95	47	73.6	3.42	
Cedarhill	98	43	74.2	1.42	
Charlotte*[10]	92	44	70.2		
Chenango Forks				2.18	
Cherry Creek				2.86	
Cooperstown†	92	40	70.4	3.02	
Cortland	94	36	69.4	3.14	
Dekalb Junction				2.80	
Dryden	95	34	71.4	5.58	
Elizabethtown	96	32	68.4	2.91	
Elmira	99	42	75.2	2.24	
Fayetteville				1.50	
Fleming	95	45	74.6	1.97	
Fort Niagara†	93	44	72.4	2.10	
Franklinville	90	32	69.2	3.24	
Garrattsville	92	37	68.8	3.20	
Glens Falls	92	50	72.8	1.64	
Gloversville	94	38	71.4	4.73	
Greenwich	96	42	72.5	1.52	
Haskinsville				4.77	
Hemlock Lake	92	40	72.7	2.57	
Honeymead Brook	96	48	71.7	2.78	
Humphrey†	89	39	70.8	2.59	
Ithaca	96	40	73.7	4.17	
Jamestown	91	43	71.6	2.18	
Keene Valley				4.04	
Kings Station				2.55	
Lake George	94	43	71.2	4.64	
Lake Placid	87	34	67.2	5.24	
Liberty	90	46	69.3	8.90	
Little Falls	93	41	72.0	3.02	
Lockport	92	44	72.6	1.65	
Lowville	92	35	69.8	1.60	
Lyndonville				1.35	
Lyons	94	43	73.8	2.96	
Madison Barracks†	95	38	72.4	0.60	
Middletown	96	45	72.9	6.45	
Milford				4.83	
Mohonk Lake*[1]	91	56	72.2		
Mount Morris				0.40	
Napoli				5.06	
Newark Valley				3.62	
New Lisbon	93	32	68.6	6.50	
Niagara Falls				1.14	
North Hammond†	92	44	72.9	0.68	
North Lake	87	39	67.2	4.00	
Number Four†	87	35	67.6	2.19	
Nunda	96	37	74.0	1.89	
Ogdensburg	90	42	71.7	4.20	
Oneonta*[1]	92	41	68.9	2.39	
Oxford	99	35	72.8	3.41	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Palermo	98	36	73.0	1.60	
Penn Yan	98	38	75.4	2.08	
Perry City	97	32	72.4	1.82	
Phenix				2.67	
Pine City				2.64	
Plattsburg Barracks†	96	43	71.3	2.09	
Port Jervis	100	42	73.6	4.51	
Poughkeepsie	102	40	73.4	3.20	
Primrose	103	42	73.4	5.40	
Ridgeway	94	42	72.7	1.35	
Rome	96	42	71.2	4.18	
Romulus	96	41	74.4	2.42	
Rose				2.07	
St. Johnsville	95	40	72.6	5.83	
Saranac Lake	91	33	68.1	3.16	
Saratoga Springs	96	43	73.2	2.30	
Scottsville				1.05	
Setauket†	98	52	72.6	7.81	
Sherwood				2.50	
Skaneateles				1.91	
South Canisteo	92	34	70.2	1.75	
Southeast Reservoir				3.52	
South Kortright†	95	32	69.8	2.56	
Straits Corners	98	36	71.4	2.40	
Ticonderoga	96	42	72.0	2.49	
Wappingers Falls	100	48	74.6	3.68	
Warwick				5.30	
Watertown	97	35	73.2	1.54	
Watkins[4]	97	39	71.8	2.87	
Waverly†	98	36	74.4	2.97	
Wedgwood	97	43	73.8	3.48	
Westfield	92	46	72.4	2.68	
Westpoint†	103	50	74.2	3.80	
Willetspoint	102	56	73.8	7.85	
North Carolina.					
Abshers	99	50	76.1	8.43	
Asheville†				6.07	
Beaufort†	92	60	79.6	5.57	
Biltmore†	94	53	73.8	6.68	
Bryson City†				6.26	
Edenton	94	61	80.3	6.38	
Experimental Farm	96°	60°	79.6°	5.59	
Fairbluff†				6.67	
Fayetteville†	96	58	78.6	5.97	
Flatrock	89	51	72.1	13.73	
Goldsboro	100	60	82.2	1.97	
Greensboro†	96	58	77.2	2.71	
Henderson†	96°	58°	78.3°	5.68	
Hendersonville	90	53	72.4	11.21	
Horse Cove	91	51	72.4	17.14	
Lenoir*†	92	60	74.5	9.39	
Linville†	83	50	67.0	9.29	
Littleton†	98	57	78.8	5.10	
Louisburg†	99	60	79.8	6.62	
Lumberton†	98	61	81.0	7.38	
Mana				6.87	
Marion	94	55	74.6	10.07	
Mocksville	97	56	78.8	7.66	
Moncure†	97	61	79.4	3.81	
Monroe†	98	59	78.4	5.10	
Morganton	96	55	77.7	6.68	
Mountairy	96	54	75.4	7.19	
Mount Pleasant	97	59	78.7	9.44	
Murphy†				6.31	
Newbern	100	64	81.6	9.19	
Oakridge†	97	56	77.0	5.82	
Pantego				7.50	
Pittsboro†	96	60	78.4	6.25	
Rockingham†	101	60	80.7	9.47	
Roxboro†	96	53	76.1	5.49	
Salem†	100	57	78.1	5.89	
Salisbury†	100	56	79.0	3.96	
Saxon†	98	56	76.4	5.44	
Selma	99	60	80.6	9.15	
Settle	102	55	77.2	5.87	
Sloan†	97	60	79.4	4.77	
Soapstone Mount†	98	52	77.0	6.13	
Southern Pines *a*†	99	61	80.2	8.46	
Southern Pines *b*	98	62	79.8	12.46	
Southport†	93	62	79.2	13.76	
Springhope*[1]	95	61	78.0	5.07	
Tarboro	103	60	81.4	8.12	
Washwoods				4.65	
Waynesville†	89	51	70.8	5.02	
Weldon†	97	62	80.8	5.46	
North Dakota.					
Amenia	94°	36°	68.4°	4.46	
Aneta	92	43	72.4	1.10	
Ashley†	100	38	71.0	1.35	
Berlin	97	36	67.4	4.32	
Bottineau	94	32	64.1	2.34	
Buxton	87	38	65.6	2.75	
Churchs Ferry	97	35	67.6	2.75	
Coal Harbor	99	36	68.8	1.21	
Devils Lake	96	37	67.9	2.84	
Dickinson	98	32	67.8	1.63	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dunseith	99	33	67.4	1.46	
Ellendale	95	40	66.9	1.72	
Fargo†	94	38	68.0	2.59	
Forman†	98	38	70.0	3.96	
Fort Berthold	101	31	69.6	3.26	
Fort Yates†	100	28	65.4	2.39	
Fullerton	101	35	68.7	2.68	
Gallatin†	96	31	66.9	2.59	
Glenullin	97	35	68.8	2.27	
Goetz	97	30	66.4	2.53	
Hamilton[1]	93*	32	65.3	1.96	
Jamestown†	98	38	69.0	3.91	
Kelso	92	40	68.0	2.19	
Langdon	92	30	63.8	2.34	
Larimore†	92	37	64.8	2.39	
Lisbon	98	38	68.3	4.10	
McKinney	98	32	64.6	2.29	
Medora†	106	35	73.4	0.95	
Melville	96	37	69.6	2.25	
Milton†	95	33	64.8	2.42	
Minnewaukon	95	35	67.0	2.50	
Minot	99	36	69.0	0.25	
Minto†	96	40	66.8	3.25	
Napoleon†	95	40	69.0	3.55	
New England City	100	38	69.0	2.55	
Oakdale†	92	45	67.0	2.25	
Pembina	96	36	66.4	1.36	
Portal	100	32	65.8	1.33	
Power†	95	37	66.8	3.39	
St. John†	91	38	65.8	3.28	
Steele	94	40	67.8	4.45	
Towner†	98	32	65.6	3.46	
University	87	39	65.8	3.76	
Valley City†	93	40	68.4	2.35	
Wahpeton†	98	39	70.7	6.30	
Washburn	100	31	68.2	3.38	
White Earth	100	33	66.5	1.00	
Wildrice†[2]			67.6	3.31	
Willow City	94	31	65.4	0.43	
Woodbridge†	93	33	65.0	2.22	
Ohio.					
Akron	97	47	75.0	3.33	
Annapolis	101	42	75.2	1.80	
Ashland	95	46	72.8	2.51	
Ashtabula	92	50	73.5	2.40	
Atwater				6.90	
Bangorville	98	46	75.4	3.46	
Basil				2.81	
Bellefontaine	95	52	76.1	3.71	
Bement				4.89	
Benton Ridge	101	45	75.8	2.34	
Bethany	104	55	79.8	1.86	
Bigprairie	98	44	74.9	5.64	
Binola				4.29	
Bladensburg	99	41	73.4	4.91	
Bloomingburg	99	46	76.7	2.16	
Bowling Green	98	44	74.2	3.17	
Bucyrus	102	50	77.2	3.15	
Cambridge	97	39	74.2	4.75	
Camp Dennison	102	48	79.7	1.68	
Canal Dover	98	41	75.4	4.57	
Canton†	95	47	75.1	3.39	
Carrollton	98	39	75.6	4.44	
Cedarville				4.51	
Celina	99	42	75.0	3.87	
Chillicothe	100	50	78.4	4.28	
Circleville	99	48	78.4	5.82	
Clarksville	99	46	77.4	3.74	
Cleveland *a*	92	53	73.7	3.38	
Cleveland *b*	96	52	74.4	3.24	
Clifton	101	42	78.0	1.97	
Coalton	99	41	77.4	4.63	
Dayton *a*	99	45	74.2	4.31	
Dayton *b*†				3.92	
Defiance	97	43	74.2	5.44	
Delaware	97	48	78.5	2.14	
Demos	95	49	74.4	7.77	
Elyria	98	47	75.0	3.51	
Fairport Harbor*[10]	90	59	74.0		
Findlay	100	47	77.3	3.20	
Frankfort	97	43	75.6	4.95	
Garrettsville†	95	42	72.4	4.55	
Granville	99	40	76.2	1.83	
Gratiot	97	42	75.8	2.70	
Greenfield	101	51	78.8	3.85	
Greenhill	94	38	73.0	4.18	
Greenville	91	49	74.2	3.88	
Hackney	97	40	73.3	3.01	
Hanging Rock	100	50	78.0	3.46	
Hedges	101	41	73.5	2.35	
Hillhouse	96	40	72.4	3.15	
Hillsboro†	104	41	78.2	6.00	
Hiram	94	40	74.0	3.20	
Hudson	99	48	74.9	3.80	
Jacksonboro	99	52	78.6	1.25	
Kenton	97	47	76.5	3.72	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Killbuck	97	44	75.0	6.56	
Lancaster	96	44	77.4	2.68	
Leipsic	100	43	74.0	9.65	
Levering	98	39	74.2	3.04	
Logan	101	49	81.2	5.42	
Lordstown	94	43	73.1	4.70	
McArthur	98	40	76.2	3.46	
McConnelsville †	97	43	76.8	2.78	
Mansfield †				1.72	
Marietta *b*	94	49	77.2	5.20	
Marion	98	44	76.3	2.21	
Medina	98	46	75.2	3.85	
Milfordton	96	39	74.8	3.00	
Milligan	103	38	76.6	4.22	
Millport	98	39	73.8	5.29	
Montpelier	98	44	73.5	5.46	
Napoleon	99	41	74.2	4.09	
Neapolis				3.78	
New Alexandria	98	47	75.2	4.41	
New Berlin	97	43	75.0	4.84	
New Bremen	98	47	75.7	3.33	
New Holland	102	44	78.0	5.20	
New Moscow				6.88	
New Paris	94	49	75.4	3.00	
New Waterford	95	40	73.6	3.70	
North Lewisburg	99	44	76.2	2.95	
North Royalton	96	48	75.4	3.39	
Norwalk	100	46	74.6	4.77	
Oberlin	97	46	74.5	4.71	
Ohio State University	99	44	76.8	3.08	
Orangeville	96	41	73.2	2.53	
Ottawa	97	49	75.8	3.85	
Pataskala †	102	40	77.1	3.03	
Perry				2.83	
Philo	100	43	77.2	5.60	
Plattsburg	95	44	76.2	1.37	
Point Marblehead *[10]	100	58	77.3		
Pomeroy *	99	48	78.2	4.41	
Portsmouth *a* †				5.27	
Portsmouth *b*	101	53	78.4	5.27	
Richwood	98	46	77.4	2.17	
Ridgeville Corners	97	42	73.8	3.44	
Ripley	96	52	77.2	8.70	
Rittman	95	45	73.4	2.64	
Rockyridge	97	47	74.5	2.85	
Rosewood	97	52	75.6	1.72	
Seaman	104	43	79.4	5.27	
Sidney *b*	100	47	78.7	1.90	
Sinking Spring †	96	47	77.0	7.00	
Somerset †	97	62	80.6	3.44	
Springboro				3.05	
Strongsville				4.25	
Sylvania	97	42	73.7	7.24	
Thurman	98	50	77.0	4.92	
Tiffin †	96	49	75.4	2.06	
Upper Sandusky	98	46	76.1	4.11	
Urbana	93	48	74.3	2.52	
Vanceburg	95	49	76.7	10.65	
Vermillion	94	50	72.9	3.21	
Vickery	98	47	74.6	6.75	
Walnut				4.00	
Warren	97	45	77.1	3.37	
Warsaw	105	40	77.0	5.77	
Wauseon	101	42	74.7	4.91	
Waverly	102	46	78.8	5.48	
Waynesville	101	47	76.7	1.30	
Wellington	98	46	75.8	8.30	
Westerville	96	45	75.6	4.52	
Willoughby				2.30	
Wooster *b* †	96	45	74.5	6.79	
Youngstown	98	40	75.4	6.04	
Zanesville †				2.28	
Oklahoma.					
Anadarko †	103	55	81.9	2.48	
Arapaho †	101	56	79.4	9.82	
Beaver	109			3.67	
Burnett †	96	51	78.6	5.22	
Clifton †	98	54	79.9	2.74	
Fort Reno †	99	58	78.0	3.13	
Fort Sill	104	55	79.8	2.20	
Guthrie	99	64	81.6	4.73	
Hennessey		62		6.43	
Hopeton	102	53	79.2	3.03	
Jefferson				3.27	
Kingfisher	101	55	80.8	6.60	
Mangum †	104	55	80.5	2.62	
Newkirk	102	56	80.4	2.71	
Norman †	97	59	79.5	4.16	
Pawhuska	96	55	78.4	6.95	
Prudence †	99	51	77.8	4.63	
Putnam	98	55	76.5	5.29	
Sac and Fox Agency	100	51	79.0	1.65	
Stillwater †	97	54	79.0	6.35	
Waukomis	104	53	80.6	5.53	
Winnview	102	55	80.3	6.90	
Oregon.					
Albany *a*	96	44	67.6	0.40	
Albany *b*				0.42	
Arlington	104	50	74.4	0.04	
Ashland *b*	104	41	68.8	0.22	
Aurora *[1]	97	55	69.0	0.05	
Aurora (near)	95	43	64.5	0.94	
Bandon	68	41	57.6	0.11	
Bay City †	81	43	59.1	1.55	
Beulah	103	30	67.6	0.12	
Burns	100	34	65.4	0.00	
Burns (near)	98	34	67.2	0.00	
Cascade Locks	94	48	67.4	1.65	
Comstock *[1]	99	49	64.2	0.43	
Coquille River				T.	
Corvallis	99	39	64.6	0.23	
Dayville †	98	42	68.4	0.05	
Ella				T.	
Fairview	90	42	60.0	0.52	
Falls City	96	42	64.0	0.34	
Gardiner	81	42	60.5	0.26	
Glenora	99	44	65.8	1.80	
Government Camp	90	31	55.9	1.82	
Grants Pass *a* †	105	39	69.8	0.00	
Happy Valley	96	31	64.2	0.04	
Heppner	100	39	67.8	0.09	
Hood River (near)	96	48	68.2	0.80	
Jacksonville	100	45	69.7	0.03	
Joseph	93	35	63.0	0.67	
Junction City *[1]	102	50	68.3	0.38	
Klamath Falls	100	37	70.5	0.00	
Lafayette *[1]	102	50	67.8	0.67	
Lagrande [1]	96	42	69.4	1.29	
Lakeview †	99	40	68.7	0.08	
Langlois	85	44	62.0	0.23	
Lone Rock	97	38	63.8	0.15	
McMinnville	100	41	65.8	0.70	
Merlin *[1]	108	50	71.6	0.00	
Monmouth *a* *[1]	102	58	68.1	0.52	
Monroe	98	43	65.8	0.29	
Mount Angel †	100	45	66.8	0.42	
Nehalem				1.26	
Newberg	102	42	66.1	0.99	
Newbridge	103	39	69.4	0.30	
Newport	67	39	56.1	0.84	
Pendleton	106	40	71.5	0.21	
Placer				0.01	
Prineville	119	29	63.5	0.11	
Riddles *[1]	103	40	67.0	0.00	
Riverside	106	31	69.7	0.11	
Salem *b* †	96	45	65.4	0.40	
Sheridan *[1]	97	50	65.7	0.40	
Silver Lake	99	30	62.7	0.20	
Silverton *[1]	100	60	70.4	0.45	
Siskiyou *[1]	100	52	74.3	0.00	
Sparta	96	39[1]	68.4[f]	0.51	
Springfield *[1]	96	53	66.7	0.30	
Stafford	98[e]	44[b]	66.4[e]	1.12	
The Dalles †	103	49	71.9	0.17	
Tillamook Rock				0.71	
Toledo	89	43	63.0	0.70	
Umatilla				T.	
Vale	102	40	69.8	0.45	
Vernonia	102	34	63.7	0.67	
West Fork *[1]	108	52	69.7	0.00	
Weston	100	42	75.5	0.13	
Williams	100	40	66.6	0.00	
Pennsylvania.					
Altoona	97	40	74.7	1.91	
Aqueduct	106	48	79.8	3.09	
Athens	101	36	73.9	2.49	
Beaver Dam				2.30	
Bethlehem				4.47	
Brookville †				2.02	
Browers Lock				3.10	
Cameron				3.72	
Carlisle	104	42	78.2	3.68	
Cassandra	93	41	72.0	3.73	
Cedarrun				1.95	
Centerhall †	94	43	72.5	2.86	
Chambersburg †	105	43	77.0	3.57	
Coatesville	101	45	77.3	3.21	
Confluence †	96	41	73.4	4.59	
Coopersburg	100	58	77.2	2.70	
Davis Island Dam †				1.35	
Derry Station	100	40	77.2	2.51	
Doylestown				3.11	
Driftwood				3.29	
Duncannon				4.91	
Dushore	95	34	70.5	2.80	
East Bloomsburg				1.61	
East Mauch Chunk	104	41	75.6	3.58	
Easton	98	48	76.2	4.89	
Ellwood Junction †				3.70	
Emporium	94	40	72.6	4.13	
Everett	100	41	74.0	2.60	
Farrandsville				5.55	
Forks of Neshaminy *[1]	98	60	77.8	4.42	
Franklin	95	39	72.6	2.18	
Frederick				2.87	
Freeport †				3.25	
Girardville				4.84	
Grampian	94	40	72.9	3.41	
Greensboro †	102	44	76.8	3.95	
Greenville	94	53	74.1	3.08	
Hamburg	107	49	78.8	5.26	
Hawley	100	42	74.0	5.48	
Hews Island Dam				1.71	
Hollidaysburg	102	39	75.8	2.36	
Huntingdon *a* †	104	39	75.2	2.97	
Huntingdon *b*				2.03	
Irwin				4.41	
Johnstown †	100	42	75.4	3.89	
Karthaus				0.22	
Keating				3.95	
Kennett Square	99	47	76.5	3.86	
Lansdale				2.86	
Lawrenceville	97			4.38	
Lebanon	104	46	77.7	3.58	
Leroy †	95	44	72.2	3.06	
Lewisburg	100	43	75.2	4.21	
Lock Haven *a* †	102	44	76.6	3.51	
Lock Haven *b*				3.76	
Lock No. 4 †				2.37	
Lycippus	97	45	75.4	3.83	
Mifflin				3.45	
Oil City †				4.45	
Ottsville				2.15	
Parker †				2.13	
Philadelphia *b*	101	55	78.1	3.80	
Point Pleasant				6.29	
Pottstown	103	52	78.6	2.13	
Quakertown	105	45	76.6	3.45	
Reading [2]			78.2	1.80	
Reedsville	100	39	73.4	1.13	
Renovo *a*				4.39	
Renovo *b*	97	42	73.9	4.43	
Ridgway †				1.87	
Saegerstown	96	36	70.8	3.62	
St. Marys	91	38	71.0	3.42	
Salem Corners	93	42	71.8	3.30	
Scranton	98	43	75.0	2.69	
Seisholtzville				2.84	
Selinsgrove	100	43	75.8	5.63	
Shawmont				5.00	
Shinglehouse	94	33	68.9	2.06	
Sinnamahoning				5.46	
Smethport	94	35	70.2	2.30	
Smiths Corners				4.27	
Somerset	96	37	70.8	4.72	
South Eaton	96	42	73.9	1.64	
State College	95	44	73.2	2.95	
Sunbury				0.52	
Swarthmore	99	54	78.5	4.95	
Swiftwater	92			3.30	
Towanda	97	38	73.2	3.15	
Trout Run				1.38	
Uniontown	98	45	75.4	6.06	
Warren †	93	41	71.7	2.90	
Wellsboro †	96	35	72.8	2.04	
West Chester	99	53	77.0	5.43	
West Newton †				3.21	
White Haven	98	39	72.6	3.35	
Wilkesbarre †	100	42	75.6	2.33	
Williamsport	97	47	75.0	1.15	
York †	104	44	77.4	3.47	
Rhode Island.					
Bristol	87	54	70.9	5.39	
Kingston	95	50	70.0	7.11	
Lonsdale				9.55	
Pawtucket	99	52	74.3	9.29	
Providence *a*	102	56	75.4	10.26	
Providence *c*	99	50	72.1	10.80	
South Carolina.					
Allendale	99	56	79.4	9.40	
Anderson †				9.01	
Batesburg †	101	57	81.8	7.00	
Blackville †	101	59	81.2	8.43	
Camden †				11.62	
Central	97	64	79.4	6.96	
Cheraw *a* †	99	59	80.5	7.43	
Cheraw *b* †				7.83	
Clemson College *a*	98	58	79.0	10.31	
Conway †				6.00	
Darlington				5.37	
Edisto †				5.25	
Effingham †				4.72	
Florence	99	61	81.8	8.39	
Gaffney †				7.08	
Georgetown †	98	67	81.4	8.50	
Gillisonville *	101	60	80.7	7.34	
Greenville †	94	57	76.9	11.20	
Greenwood	102	59	80.8	4.92	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Holland	99	58	77.6	7.56	
Kingstree *a* †	101	60	82.0	5.49	
Kingstree *b*				5.19	
Little Mountain	101	54	79.3	6.46	
Longshore †	99[b]	56	78.1[e]	9.92	
Mount Carmel †				8.93	
Pinopolis *[1]	94	64	78.9	6.13	
Port Royal †	99	63	82.0	9.30	
St. Georges †	98	61	80.7	6.97	
St. Matthews †	99	60	80.4	7.46	
St. Stephens †				7.89	
Santuck †	96	59	78.8	8.54	
Shaws Fork	97[d]	57[d]	79.0[d]	5.57	
Smiths Mills †				7.16	
Spartanburg	98	57	79.7	6.90	
Society Hill †	95	61	80.4	9.27	
Statesburg †	98	59	80.5	6.73	
Summerville				7.17	
Trenton	95	58	80.2	11.37	
Trial	96	59	77.7	9.60	
Walhalla	96	57	76.2	9.00	
Winnsboro	94[e]	55	78.7	6.83	
Yemassee †	101	61	82.0	6.80	
Yorkville	98	59	79.7	6.18	
South Dakota.					
Aberdeen †	99	45	71.4	3.65	
Alexandria †	100	45	71.6	2.74	
Armour	99	47	72.6	4.57	
Ashcroft †	100	39	70.1	1.31	
Bowdle	103	38	71.6	2.39	
Brookings †	94	42	70.4	1.56	
Canton	92	49	71.2	3.84	
Centerville				3.36	
Chamberlain †	100	50	74.2	4.64	
Chandler				3.84	
Clark				2.56	
Desmet	93	42	69.6	2.08	
Doland	98[f]	44	72.3[e]	2.72	
Farmingdale				3.45	
Flandreau	97	45	70.8	1.45	
Forestburg †	94	46	71.2	5.49	
Forest City	102	47	75.5	0.65	
Fort Meade †	99	50	72.3	1.30	
Gannvalley	95	46	71.9	5.05	
Gary	96	50	70.7	3.39	
Goudyville	101	41	70.6	1.22	
Harney	96	37	67.7	2.92	
Highmore	102	52	75.2	2.34	
Hitchcock				2.67	
Hotch City †	104	42	75.3	4.98	
Hot Springs	97	43	71.2	1.11	
Howard †	96	43	72.0	2.45	
Interior	106	42	78.0	4.00	
Ipswich	100	42	71.2	0.86	
Kimball †	99	46	71.8	4.89	
Leslie †	112	42	78.7	1.69	
Mellette †	103	45	74.1	1.24	
Menno †	100	47	73.7	3.86	
Millbank	92	45	69.2	2.73	
Mitchell †	96	46	70.4	4.02	
Montrose	94	48	70.0	2.46	
Nowlin	103	35	74.8	0.19	
Oelrichs †	107	38	73.8	2.20	
Parker †				3.13	
Parkston	98	43	69.8	4.63	
Plankinton †	98	42	72.3	4.36	
Redfield	100	46	70.9	2.75	
Rochford				3.76	
Rosebud	105	38	73.5	2.77	
Silver City				3.16	
Sioux Falls †	93	46	71.8	3.08	
Spearfish †	94	44	70.0	1.90	
Tyndall †	96	49	73.3	4.31	
Watertown	98	40	67.6	4.54	
Wentworth †	93	48	71.4	2.10	
Wessington Springs	92	49	68.6	6.92	
Whiteswan	98	52	74.4	5.39	
Wolsey				3.58	
Tennessee.					
Andersonville	98	57	78.4	5.07	
Arlington	98	58	79.8	4.01	
Ashwood	99	57	78.6	5.65	
Benton (near) †	98	55	78.8	7.69	
Bluff City †				6.25	
Bolivar †	99	55	78.2	4.03	
Bristol †	96	54	74.4	5.70	
Brownsville	103	59	80.6	7.66	
Byrdstown	94	55	76.4	5.24	
Carthage †	97	56	78.8	5.70	
Center Point				4.92	
Clarksville	94	58	77.4	6.00	
Clinton †				5.64	
Covington	96	59	80.6	2.09	
Decatur †	97	59	78.6	6.98	
Dover	97	53	78.2	7.38	
Dyersburg	100	58	80.0	3.46	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum	Mean.	Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Elizabethton †	104	55	77.4	4.44	
Elk Valley	96	53	75.9	6.10	
Erasmus	95	51	73.5	4.72	
Florence †	97	59	78.2	3.66	
Franklin	95	58	77.8	6.19	
Grace *[5]	100	58	79.0	9.10	
Greeneville †	96	56	75.2	2.80	
Harriman	95	59	78.4	6.59	
Hohenwald †	98	54	78.2	6.08	
Jackson †	94	56	78.4	3.88	
Johnsonville	97	54	78.8	2.29	
Jonesboro *[1]	93	59	73.8	6.32	
Kingston †				6.01	
Lafayette *[5]	94	56	76.9	5.16	
Lewisburg *[5]	99	60	78.6	7.09	
Liberty †	95	56	78.2	6.74	
Lynnville †	95	60	78.2	8.25	
McKenzie †	94	57	78.5	4.71	
McMinnville †	99	53	77.6	6.60	
Madison		57		6.42	
Maryville *[5]	98	58	79.4	4.53	
Milan	98	59	80.4	8.30	
Nashville (near)	94	61	78.5	4.61	
Newport †	99	58	77.8	5.43	
Nunnelly	95	55	77.1	6.14	
Oak Hill	96	56	76.4	7.08	
Palmetto †	101	57	79.6	7.11	
Peryear *[5]	96	58	78.3	5.77	
Pope	97	53	78.4	5.84	
Rogersville †	92	57	74.7	5.70	
Rugby	95	54	75.4	5.73	
Savannah	101	59	80.2	5.46	
Sewanee †	93	55	74.8	10.56	
Silverlake	90	52	70.8	4.72	
Springdale	99	51	77.5	5.44	
Springfield	98	55	79.2	6.35	
Sylvia	98	54	77.0	7.15	
Tazewell				4.52	
Tellico Plains †	99	55	78.3	5.88	
Tracy City	93	55	74.5	8.10	
Trenton	94	57	76.8	4.67	
Tullahoma †	97	55	77.0	7.60	
Union City	96	57	78.2	6.15	
Wildersville	93	59	78.0	5.15	
Yukon	97	60	78.0	8.08	
Texas.					
Albany *[1]	98	60	81.2	5.52	
Alvin				2.30	
Anna				0.25	
Arthur City †				4.99	
Austin *a*	102	65	84.0	3.20	
Austin *b* *[5]	99	62	80.2		
Ballinger †	101	56	79.4	1.09	
Beaumont	95	68	80.5	4.77	
Beeville †	106	65	85.3	0.90	
Blanco †	100	68	83.4	2.90	
Boerne *[1]	99	64	80.4	1.66	
Brazoria †	96	65	81.0	2.09	
Breckenridge	103	64	83.2	5.88	
Brenham †	101	66	81.8	3.34	
Brighton	98	62	79.6	1.05	
Brownwood	105			1.37	
Burnet *[1]	102	61	79.6	1.32	
Childress	101	59	81.2	3.83	
Coleman	99	62	80.0	0.64	
College Station [2]	98		81.4	2.60	
Colmesneil				5.06	
Colorado				0.97	
Columbia †	95	65	80.4	0.17	
Conroe	102	65	81.7	4.80	
Corsicana *b* †	104	63	84.0	2.78	
Cuero †	100	66	83.6	3.94	
Dallas †	101	62	81.2	2.74	
Danevang †	104	65	83.2	3.35	
Dublin †	103	60	81.2	1.09	
Duval *[1]	109	70	86.0	1.30	
Emory	99	58	79.4	1.61	
Estelle †	104	58	82.0	1.81	
Forestburg				1.76	
Fort Clark	102	68	84.7	0.53	
Fort McIntosh	106	68	87.7	0.15	
Fort Ringgold †	110	60	84.5	0.68	
Fort Worth	105	62	83.8	1.85	
Fredericksburg *† [1]	100[b]	60[d]	80.6[d]	1.68	
Fruitland	110	61	82.8	1.61	
Gainesville	101	60	81.2	2.51	
Golindo				1.05	
Grapevine	105	61	82.2	1.61	
Hale Center †	98	60	76.8	2.33	
Hallettsville †	103	64	84.6	1.81	
Haskell	108	58[e]	82.0[e]	2.83	
Hearne	100	66	84.4	2.00	
Henrietta	108	60	84.0	1.38	
Hewitt				3.15	
Honeygrove				1.34	
Houston †	94	66	81.2	4.89	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Hulen	103			4.02	
Huntsville †	99	64	81.6	3.26	
Jacksonville	101	58	80.6	1.55	
Jasper	100	67	81.7	2.73	
Junction				5.91	
Kent				2.44	
Kerrville	100	55	78.5	2.35	
Lampasas †	104	57	81.5	2.32	
Langtry	100			3.37	
Llano *† [5]	103	64	83.8	1.45	
Longview †	104	63	84.0	1.17	
Luling †	102	66	84.0	2.43	
Mann	106	62	81.8	5.00	
Marshall	95	64	81.0	0.70	
Menardville	105	54	79.3	1.99	
Mount Blanco †	98	58	78.0	2.18	
New Braunfels †	106	64	83.6	3.02	
Panter				1.94	
Paris	103	61	81.6	1.23	
Point Isabel *[1]	92	80	84.1	0.35	
Rheinland †	105	61	83.8	4.77	
Roby	101[1]	56	80.3[f]	1.32	
Rockport *[1]	88	70	81.7		
Rocksprings				0.45	
Runge †	101	61	84.2	0.66	
San Antonio	105	67	84.8	1.90	
San Marcos *b* †	103	61	82.2	1.09	
Sherman	101	63	82.8	0.90	
Sugarland				1.32	
Temple *a*	101	66	82.3	0.73	
Temple *b*	109	66	82.7	0.38	
Tulia	98	54	76.8	4.67	
Tyler	101			4.01	
Valentine †	107	47	77.3	0.45	
Victoria				4.33	
Waco	106	64	85.8	1.35	
Waxahachie †	105	60	82.2	1.25	
Weatherford †	103	61	81.7	0.99	
Wichita Falls †				1.96	
Utah.					
Alpine †				0.19	
Blue Creek *[1]	100	50	76.5	0.10	
Brigham				0.03	
Cisco †	106	54	82.8	T.	
Corinne	100	46	76.2	T.	
Ferron	99	50	77.9	0.64	
Fillmore †	107	32	74.5	0.99	
Fort Duchesne †	99	41	72.2	0.66	
Frisco	102	47	76.2	0.97	
Giles	110	49	81.8	0.36	
Heber	98	34	67.8	0.25	
Huntsville				0.48	
Kelton *[1]	101	65	81.4	0.00	
Levan †	95	38	70.8	1.62	
Loa	96	30	65.7	0.60	
Millville				0.10	
Minersville	100	43	74.7	0.51	
Moab †	101	49	77.8	0.17	
Mount Pleasant †	108	39	76.8	0.39	
Ogden *a* *[1]	99	48	78.6	0.00	
Pahreah	106	54	77.6	0.01	
Parowan †	96	43	71.5	1.19	
Pinto	100	36	69.1	0.07	
Promontory *[1]	100	56	73.8	T.	
Provo	105	39	73.6	0.35	
Richfield †	102			0.40	
St. George †	115	54	84.5	0.05	
Scipio †	98	34	71.4	0.19	
Snowville	96	37	0.8	0.06	
Soldier Summit	95	28	62.7	T.	
Terrace *[1]	96	51	73.1	T.	
Thistle	99	40	70.6		
Tooele †	94	46	72.8	0.14	
Tropic	96	41	69.2	0.58	
Vernal	94	44	72.8	0.34	
Woodruff	94	31	62.8	0.17	
Vermont.					
Bennington	95	42	72.5	1.25	
Burlington †	89	49	71.5	1.51	
Chelsea †	90	38	67.8	2.28	
Cornwall	98	42	71.6	1.45	
Hartland †	93	36	67.8	1.89	
Jacksonville	88	38	67.0	1.75	
Norwich	92	35	69.4	1.11	
St. Johnsbury	92	36	69.2	6.60	
Vernon *[6]	96	52	73.4	2.33	
Wells	92	40	70.4	2.46	
Woodstock	95	36	67.6	2.93	
Virginia.					
Alexandria	105	53	80.2	3.22	
Ashland †	99	55	78.0	4.42	
Barboursville	97	54	76.8	4.69	
Bedford City	103	55	78.9	4.26	
Bigstone Gap †	97	50	75.4	10.23	
Birdsnest *† [1]	96	66	79.7	2.85	
Blacksburg	91	49	71.8	3.70	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Buckingham †....	99	51	76.6	5.00	
Burkes Garden	91	45	69.8	5.31	
Callaville†	95	56	77.2	4.00	
Charlottesville	95	55	75.8	7.89	
Christiansburg				4.21	
Clarksville				4.27	
Clifton Forge	99	48	76.5	3.69	
Dale Enterprise†	100	44	73.2	6.24	
Danville				2.35	
Doswell	104	54	78.7	5.23	
Farmville	103	56	78.8	6.63	
Fredericksburg†	103	53	79.2	3.10	
Hampton	95	65	79.4	4.15	
Hot Springs	94	44	70 2	5.10	
Lexington†	95[f]	53[f]	74.4[f]	4.44	
Maidens				5.56	
Manassas†	101	52	78.4	3.06	
Marion	97[e]	51[e]	74.3[e]	6.03	
Petersburg†	98	56	78.8	4.74	
Richmond (near)†	105	56	79.4	3.50	
Rockymount†	98	58	77.0	7.75	
Salem†	94	58	78.2	5.06	
Speers Ferry				9.20	
Spottsville†	98	62	79.4	7.80	
Stanardsville†	100	52	75.2	5.22	
Staunton†	103	50	75.5	4.41	
Stephens City†	103	50	77.4	2.27	
Sunbeam†	96	60	78.6	6.10	
Warrenton	101	60	79.3	2.54	
Warsaw†	102	60	79.2	5.80	
Westpoint	96	51	76.2	4.52	
Woodstock†	105			3.56	
Wytheville†	96	48	73.6	5.63	
Washington.					
Aberdeen	93	41	60.0	0.97	
Ashford †				1.35	
Blaine†...	89	34	59.0	0.90	
Bridgeport	104	35	73.9	0.00	
Brinnon	85	48	64.0	0.48	
Cedar Lake				1.73	
Centerville†	107	33	67.2	0.14	
Clearwater	91	43	61.5	1.97	
Colfax	92	36	65.0	0.39	
Coupeville†	94	43	68.2	0.61	
Ellensburg	95	41	68.2	0.05	
Ellensburg (near)	104	42	71.0	0.10	
Fort Simcoe†	101	41	69.8	0.00	
Fort Spokane	104	39	69.8	2.00	
Grandmound†	97	41	64.0	0.47	
Hunters†	89	33	59.8	1.17	
Kennewick†	105	45	76.4	0.00	
Lacenter	99	46	65.4	0.96	
Lakeside	97	51	73.7	T.	
Lapush	65	44	54.4	1.30	
Loomis†	99	46	70.4	0.76	
Madrone †	90	42	62.2	0.39	
Moxee Valley†	100	44	72.0	0.02	
New Whatcom	83	43	60.4	0.91	
Northbend	90	40	64.0	0.80	
Olga	80	42	57.8	0.46	
Olympia†	96	43	64.2	0.28	
Orcas Island	88	43	62.8	0.16	
Pinehill†	103	44	69.1	0.25	
Pomeroy	100	52	75.0	0.05	
Port Townsend	86	48	60.4	0.72	
Pullman†	95	38	65.6	0.51	
Rosalia†	94	37	64.6	0.48	
Sedro†	92	40	63.6	1.08	
Shoalwater Bay *[10]	80	51	60.1		
Snohomish†	92	55	69.8	T.	
Southbend	95	42	61.6	0.92	
Stillaguamish	91	38	59.4	0.05	
Sunnyside†	101	45	72.4	0.00	
Union City†	93	42	63.2	0.48	
Vancouver	93	46	65.1	0.85	
Vashon†	88	47	62.8	0.37	
Waterville	97	38	66.0	0.06	
West Virginia.					
Beckley	90	46	71.2	2.14	
Beverly†	98	40	71.8	8.33	
Bluefield	94	51	72.8	6.42	
Buckhannon *a*†				4.16	
Buckhannon *b* *	97	42	74.6		
Burlington †.....	102	40	75.2	1.92	
Charleston †....				4.86	
Dayton †.....	99	40	75.2	4.47	
Eastbank	98	52	75.4	4.60	
Elkhorn†.....	94	51	73.1	7.33	
Fairmont†				3.10	
Glenville†	94	45	72.9	4.41	
Grafton†	96	43	73.7	4.36	
Green Sulphur	95	49	74.7	1.62	
Harpers Ferry				2.12	
Hinton *a*†				5.34	
Hinton *b*†	97	51	76.4		
Huntington	99	50	77.6	4.41	
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kingwood	91	41	72.4	2.74	
Marlinton †	91	42	71.2	6.76	
Martinsburg†	103	52	76.8	3.20	
Morgantown *b*†	98	48	75.2	4.01	
New Cumberland	95	47	77.6	6.40	
New Martinsville	101	40	77.8	6.33	
Nuttallburg	95	43	72.3	6.80	
Oldfields†	100	41	74.1	3.25	
Philippi	100[d]	43[d]	75.8[d]	3.91	
Point Pleasant†	100	50	78.8	2.79	
Powellton	93	48	74.4	7.58	
Romney	102	45	75.8	2.66	
Rowlesburg†				1.53	
Upper Tract	102	40	74.9	4.23	
Weston *a*				3.81	
Weston *b* *† [1]	102	47	77.0		
Wheeling *a*†				5.81	
Wheeling *b*†	103	48	74.6	5.72	
Wisconsin.					
Amherst	93	39	70.0	2.61	
Barron	90	38	66.2	1.90	
Bayfield	96	44	70.6	0.55	
Beloit	92	50	73.0	4.79	
Brodhead	94	48	72.1	4.22	
Chat				1.30	
Citypoint	97	46	73.0	3.80	
Delavan	93	42	71.2	2.59	
Dodgeville†	92	47	71.2	2.70	
Easton	94	41	71.3	4.39	
Eau Claire	95	48	73.2	1.27	
Florence †	90	36	66.2	3.71	
Fond du Lac	95	43	71.6	3.23	
Grand River Locks				3.78	
Grantsburg†	95	41	70.2	1.59	
Hartford	91	42	67.6	2.31	
Hartland	98	39	72.7	2.83	
Harvey	93	47	72.6	3.97	
Hayward	97	39	70.8	1.44	
Heafford Junction *[1]	93	50	69.3	2.76	
Hillsboro	94	39	70.2	3.35	
Knapp	92	42	69.8	2.11	
Koepenick *†[1]	92	54	68.4	2.60	
Lancaster†	96	47	73.3	4.90	
Lincoln	92	45	70.2	3.08	
Madison†	90	54	73.1	2.83	
Manitowoc†	92	44	66.6	2.63	
Meadow Valley†	95	39	70.4	4.31	
Medford †	101	35	70.6	2.25	
Menasha				3.13	
Neillsville	94	34	70.0	2.84	
New Holstein	95	41	68.9	1.85	
New London	92	44	70.1	4.73	
North Crandon	95			2.65	
Oconto	93	41	66.4	2.81	
Osceola†	95	41	69.8	1.32	
Pepin	94	42	72.0	2.15	
Pine River†				3.12	
Portage†	95	44	70.8	2.18	
Port Washington	92	46	69.0	2.25	
Prairie du Chien	97	49	74.8	3.25	
Prentice *[1]	96	49	66.4	2.20	
Racine	94	50	71.3	3.24	
Sharon	93[c]			2.66	
Shawano	92	43	69.4	3.00	
Sheboygan *[10]	85	51	70.5		
Spooner	99	37	71.4	0.69	
Stevens Point†	94	41	71.2	1.45	
Sturgeon Bay Canal *[10]	80	45	64.5		
Two Rivers *[10]	83	50	68.4		
Valley Junction†	93	37	69.0	3.27	
Viroqua	95	46	72.0	3.19	
Watertown†	92	45	71.4	3.08	
Waukesha†	94	53	73.0	2.81	
Waupaca†	96	42	72.0	3.10	
Wausau †	93	44	70.2	4.04	
Wausaukee	96	40	71.7	3.78	
Westfield †	92	46	72.0	5.89	
Westpark	94	46	71.2	2.60	
Whitehall	94	40	72.1	3.40	
White Mound	96	39	71.0	3.10	
Wyoming.					
Basin	101	44	73.4	0.10	
Big Horn Ranch	84	30	59.3	1.57	
Big Piney	83	33	59.2	0.97	
Bitter Creek	105	34	72.5	0.01	
Carbon	102	38	71.8	0.18	
Cody				0.44	
Embar	94	40	69.0		
Evanston	90	32	63.2	0.22	
Fort Laramie†	102	40	72.4	1.61	
Fort Washakie	91	38	66.0	0.35	
Fort Yellowstone†	87	32	62.1	1.15	
Green River	100	36	67.7		
Laramie	88	38	64.9	0.65	
Lovell	100	36	68.0	0.86	
Lusk †	99	40	70.4	0.67	
Wyoming—Cont'd.	°	°	°	*Ins.*	*Ins.*
Otto	95	40	67.8	1.48	
Sheridan	97	37	67.3	0.44	
Sundance	95	41	68.8	1.71	
Wamsutter	100	32	66.6	T.	
Wheatland	100	44	72.8	2.34	
Mexico.					
Ciudad P. Diaz...	97	72	85.9	1.11	
Leon de Aldamas	84	55	68.1	9.24	
Puebla	79	47	62.1	5.00	
Topolobampo *[1]	95	77	85.0	1.98	
New Brunswick.					
St. John	75	51	61.4	1.03	

Late reports for June, 1898.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.					
Tuscumbia	97	65	80.2	2.54	
Alaska.					
Coal Harbor	60	32	44.6	7.08	T.
California.					
Agnew	90	38	62.1	0.00	
Chino *[6]	98	56	71.3	0.00	
Kernville				0.00	
Manzana				0.00	
San Miguel Island	90	48	59.1	0.70	
Tulare *b*				0.00	
Westpoint				0.00	
Colorado.					
Rico	86	23	53.5	1.60	
Illinois.					
Atwood *a* *[3]	92	56	71.0	6.44	
Iowa.					
Millman				7.29	
Monticello	93	53	72.6		
Stuart	95	53	73.2	6.20	
Villisca	93	51	71.8	3.92	
Kansas.					
Garden City	96	50	73.6	6.39	
Garfield				3.33	
Seneca	94	57	47.2	3.41	
Yates Center	97	57	76.4	5.46	
Massachusetts.					
Taunton *b*	87	37	64.2	1.75	
Mississippi.					
Leakesville				6.38	
Montana.					
Kalispell	92	45	64.2	1.13	
Radersburg				0.95	
Nebraska.					
Norman				4.12	
Sargent				2.68	
State Farm				4.91	
Whitman				1.70	
Nevada.					
Osceola	92	34	69.0		
Texas.					
Fort Clark	101	58	79.2	7.45	
Wyoming.					
Laramie	88	29	56.4		

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

† Weather Bureau instruments.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[8] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 3.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[c] [n]" denotes 14 days missing.

CORRECTIONS.

Nebraska, Monroe, May, 1898, make precipitation read 5.39 instead of 5.09.

Oakdale, May 1898, make maximum and mean temperature read 88 and 57.2, respectively, instead of 90 and 57.4.

TABLE III.—*Data furnished by the Canadian Meteorological Service, July, 1898.*

Stations.	Pressure.			Temperature.				Precipitation.			Stations.	Pressure.			Temperature.				Precipitation.		
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.		Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*			*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	*Ins.*	
St. Johns, N. F.	29.87	30.01	+.04	59.0	− 0.3	67.8	50.2	2.60	.....	....	Saugeen, Ont.	29.34	30.03	+.10	67.4	+ 2.7	77.4	57.3	0.16	−1.87	....
Sydney, C. B. I.	30.00	30.04	+.13	62.9	+ 0.6	71.9	53.9	2.51	−1.99	....	Parry Sound, Ont.	29.33	30.00	+.08	68.4	+ 2.4	79.5	57.3	0.23	−2.20	....
Halifax, N. S.	29.94	30.07	+.15	65.2	+ 1.8	73.8	56.6	3.65	−0.60	....	Port Arthur, Ont.	29.26	29.94	+.06	60.4	− 1.6	69.6	51.3	4.58	+1.57	....
Grand Manan, N. B.	29.97	30.02	+.07	62.3	+ 0.6	70.4	54.1	1.04	−2.80	....	Winnipeg, Man.	29.08	29.88	−.01	65.7	− 0.3	77.4	54.0	1.77	−1.45	....
Yarmouth, N. S.	29.98	30.06	+.13	60.8	+ 1.3	68.9	52.8	6.63	+3.56	....	Minnedosa, Man.	28.14	29.89	+.05	63.5	+ 1.3	74.5	52.5	4.78	+2.24	....
Charlottet'n, P. E. I.	29.97	30.01	+.09	65.3	+ 1.2	71.6	58.9	3.35	−0.62	....	Qu'Appelle, Assin.	27.66	29.84	−.02	64.1	+ 0.6	77.0	51.3	2.25	−0.20	...
Chatham, N. B.	29.95	29.97	+.09	67.8	+ 2.8	79.0	56.6	3.96	−0.74	....	Medicine Hat, Assin.	27.62	29.82	−.02	69.3	+ 1.5	84.6	54.0	2.45	+0.73	....
Father Point, Que.	29.92	29.96	+.12	58.1	+ 0.5	68.8	47.3	2.35	−0.87	....	Swift Current, Assin.	27.38	29.86	−.04	66.3	− 0.2	80.7	51.9	2.81	+0.69	....
Quebec, Que.	29.66	29.98	+.11	67.5	+ 2.0	77.9	57.1	3.43	−0.53	....	Calgary, Alberta	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Montreal, Que.	29.80	30.00	+.12	70.4	+ 1.9	79.3	61.5	2.11	−2.46	....	Banff, Alberta	25.38	29.92	.....	56.2	.....	71.4	40.9	4.54	.....	....
Rockliffe, Ont.	29.49	29.98	+.09	68.1	+ 3.5	81.9	54.3	1.50	−1.62	....	Edmonton, Alberta.	27.59	29.82	−.07	62.9	+ 2.3	76.2	49.6	2.00	−1.10	....
Ottawa, Ont.	29.69	30.04	.....	70.6	+ 1.1	83.0	58.2	2.87	.....	....	Prince Albert, Sask.	28.30	29.76	.....	63.3	+ 1.4	76.1	50.6	1.95	.....	....
Kingston, Ont.	29.70	30.01	+.11	70.3	+ 2.1	78.3	62.3	0.16	−3.10	....	Battleford, Sask.	28.16	29.84	.....	65.2	+ 0.5	78.3	52.0	1.09	.....	....
Toronto, Ont.	29.65	30.02	+.08	71.5	+ 3.5	82.9	61.1	0.69	−2.28	....	Kamloops, B. C.	28.64	29.87	.....	70.0	.....	83.2	56.8	0.88	.....	....
White River, Ont.	28.67	29.99	+.04	61.0	+ 1.5	73.7	48.4	3.77	+0.46	....	Esquimalt, B. C.	30.01	30.04	.....	60.3	+ 0.3	70.0	50.7	0.28	.....	....
Port Stanley, Ont.	29.41	30.03	+.06	70.2	+ 2.4	80.7	59.7	2.41	−1.14	...	Hamilton, Bermuda.	30.01	30.17	+.08	79.3	+ 0.9	85.0	73.6	2.90	.....	....

TABLE IV.—*Mean temperature for each hour of seventy-fifth meridian time, July, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N Dak.	65.3	63.9	62.3	61.0	60.1	58.8	58.5	61.1	64.7	68.2	70.8	73.3	75.5	77.6	78.7	79.7	80.1	80.1	79.1	78.1	75.5	72.2	69.4	66.8	70.0
Boston, Mass.	67.7	67.1	66.6	65.9	65.3	66.1	68.0	70.3	72.5	73.9	75.3	76.1	76.4	76.3	76.4	75.2	75.0	74.7	73.1	71.5	70.8	70.0	69.3	68.5	71.3
Buffalo, N. Y.	69.6	68.9	68.0	67.5	67.1	67.6	69.8	71.3	73.6	74.8	75.6	76.5	77.2	78.0	77.9	77.8	77.3	77.0	75.7	74.6	73.2	72.4	71.0	70.3	73.0
Chicago, Ill.	72.0	71.2	70.8	70.3	69.4	68.8	69.8	71.3	73.6	74.6	74.9	75.3	75.8	76.3	76.9	77.0	77.1	76.8	76.5	75.0	73.5	72.7	72.5	72.2	73.5
Cincinnati, Ohio	74.9	74.1	73.0	72.1	71.2	70.4	70.2	73.1	75.1	77.8	80.2	82.3	84.0	84.6	85.2	85.3	85.2	85.0	83.3	81.8	80.3	78.9	77.2	75.9	78.4
Cleveland, Ohio	70.7	70.3	69.5	68.7	68.0	68.2	69.3	71.3	73.9	75.0	75.6	75.5	75.5	75.6	76.2	75.9	76.5	76.2	75.7	75.5	74.3	73.0	71.8	70.9	73.0
Detroit, Mich.	68.7	67.7	66.7	66.2	65.4	65.2	66.8	69.7	72.6	74.6	76.6	77.6	78.5	79.7	79.9	80.4	80.2	79.4	78.0	76.4	73.9	72.0	70.7	69.7	73.2
Dodge, Kans.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eastport, Me.	55.3	55.2	54.8	54.7	54.7	55.6	57.3	59.0	60.6	62.6	63.3	64.2	65.3	65.5	65.0	64.2	63.2	62.4	60.1	59.3	57.7	57.0	57.0	56.5	59.6
Galveston, Tex.	80.9	80.7	80.5	80.3	79.7	79.8	79.7	80.4	80.5	81.6	82.7	84.1	85.0	85.1	85.6	85.2	84.9	84.7	83.9	83.2	82.5	82.1	81.8	81.5	82.9
Havre, Mont.	64.5	62.9	61.8	60.2	58.8	57.7	56.7	57.5	59.9	63.5	67.3	71.1	73.8	75.2	76.6	77.8	78.3	78.7	78.4	77.6	76.3	74.6	70.7	67.7	68.7
Kansas City, Mo.	74.2	73.5	72.4	71.5	70.9	70.0	69.8	70.8	73.3	75.5	78.2	80.1	81.8	83.1	84.2	85.0	85.3	85.4	83.9	82.3	80.6	77.5	75.6	74.7	77.5
Key West, Fla.	80.7	80.5	80.4	80.5	80.1	80.5	81.9	83.2	84.0	84.8	85.9	86.4	86.3	86.3	85.9	85.6	84.6	83.9	82.9	82.6	82.1	81.8	81.5	81.1	83.1
Memphis, Tenn.	75.4	74.7	74.2	73.5	72.9	72.4	72.0	74.5	75.5	77.1	79.4	81.5	83.2	84.1	84.5	84.6	85.0	84.8	82.6	80.7	79.1	78.0	76.9	75.8	78.4
New Orleans, La.	77.5	77.1	76.8	76.6	76.3	76.0	76.1	77.6	79.3	80.5	82.2	83.6	84.7	85.0	84.6	84.5	84.3	84.0	82.9	81.8	80.3	79.2	78.6	78.0	80.3
New York, N. Y.	70.5	69.7	69.2	68.9	68.4	68.5	69.1	70.5	72.2	74.4	75.9	76.9	78.0	78.9	78.9	78.4	77.3	76.2	74.6	73.9	73.3	72.6	71.6	71.1	73.3
Philadelphia, Pa.	72.3	71.8	71.1	70.6	70.1	70.5	72.2	74.0	75.9	78.3	80.2	82.1	83.7	84.8	85.7	85.5	84.5	82.8	79.9	78.0	76.3	75.0	74.2	73.3	77.2
Pittsburg, Pa.	73.0	72.0	71.0	70.5	69.7	69.1	70.2	72.5	75.5	77.8	79.6	81.5	83.2	84.2	84.0	83.8	82.8	81.7	80.5	79.1	77.6	76.4	74.8	74.0	76.6
Portland, Oreg.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.	75.6	74.6	73.7	72.9	72.0	71.6	71.5	73.0	74.8	77.3	79.5	81.5	82.7	83.5	84.3	84.7	84.8	83.8	82.9	81.5	80.2	78.9	77.5	76.2	78.3
St. Paul, Minn.	69.5	68.1	66.4	65.5	64.5	63.5	63.8	65.5	67.7	70.5	73.4	75.7	77.5	78.6	80.0	80.9	81.6	81.8	81.1	79.5	77.4	75.1	73.0	71.2	73.0
Salt Lake City, Utah	72.6	71.3	69.8	68.2	67.9	67.9	66.7	66.5	67.7	71.5	75.1	78.9	81.4	83.2	85.0	85.5	86.4	86.6	86.5	86.4	84.4	79.6	76.4	74.3	76.7
San Diego, Cal.	64.3	64.0	63.7	63.5	63.4	63.2	63.1	63.1	63.1	63.5	64.6	66.2	67.6	68.5	69.3	69.7	69.9	69.7	69.3	68.3	67.4	66.1	65.1	64.6	65.9
San Francisco, Cal.	53.0	52.7	52.6	52.2	52.1	52.1	51.9	52.3	51.9	52.4	53.5	55.1	56.9	58.1	59.4	59.9	60.0	59.5	58.4	57.3	56.2	54.9	53.7	53.0	55.0
Savannah, Ga.	76.2	76.0	75.6	75.3	75.1	75.0	76.4	78.4	80.9	82.8	83.8	85.4	86.0	86.2	85.8	84.2	82.2	81.3	80.2	79.2	78.2	77.7	77.1	76.6	79.8
Washington, D. C.	73.2	72.8	72.0	71.3	70.7	70.7	72.4	75.0	77.9	79.7	81.8	83.6	85.0	85.1	85.4	85.3	84.3	83.3	81.5	79.0	77.3	75.7	74.8	74.1	78.0

TABLE V.—*Mean pressure for each hour of seventy-fifth meridian time, July, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak.	28.208	.211	.212	.215	.217	.215	.222	.227	.230	.231	.224	.218	.212	.202	.193	.178	.167	.163	.150	.159	.165	.175	.180	.196	.200
Boston, Mass.	29.903	.900	.899	.904	.912	.925	.931	.932	.929	.928	.920	.913	.901	.894	.885	.882	.882	.884	.888	.896	.904	.907	.907	.906	.905
Buffalo, N. Y.	29.230	.230	.220	.220	.228	.235	.245	.248	.246	.245	.243	.239	.229	.216	.208	.201	.194	.193	.197	.199	.211	.211	.213	.216	.221
Chicago, Ill.	29.173	.173	.172	.169	.176	.184	.196	.205	.209	.212	.207	.208	.198	.188	.177	.165	.152	.142	.140	.140	.154	.160	.162	.167	.176
Cincinnati, Ohio	29.392	.389	.388	.389	.396	.407	.415	.423	.424	.423	.422	.412	.400	.388	.376	.362	.355	.351	.355	.358	.369	.382	.384	.387	.389
Cleveland, Ohio	29.239	.237	.234	.237	.244	.251	.255	.264	.263	.264	.265	.262	.251	.243	.231	.223	.219	.211	.215	.217	.227	.235	.234	.237	.240
Detroit, Mich.	29.276	.272	.269	.269	.277	.283	.289	.295	.304	.304	.302	.294	.284	.272	.264	.255	.247	.241	.245	.247	.256	.264	.269	.271	.273
Dodge, Kans.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Eastport, Me.	29.925	.924	.923	.926	.932	.941	.945	.948	.947	.945	.939	.933	.928	.924	.916	.912	.908	.909	.915	.934	.928	.933	.933	.932	.929
Galveston, Tex.	29.957	.955	.950	.948	.951	.954	.964	.972	.986	.992	.993	.994	.987	.976	.965	.951	.937	.927	.924	.927	.935	.945	.955	.955	.958
Havre, Mont.	27.319	.321	.319	.316	.319	.323	.332	.336	.341	.344	.340	.335	.329	.321	.312	.304	.295	.288	.279	.274	.276	.283	.297	.311	.313
Kansas City, Mo.	29.025	.025	.021	.019	.019	.027	.034	.041	.053	.055	.057	.055	.044	.031	.016	.005	.989	.979	.976	.975	.986	.004	.019	.023	.020
Key West, Fla.	30.050	.050	.043	.039	.039	.044	.050	.054	.054	.050	.074	.073	.065	.051	.038	.027	.022	.028	.037	.049	.055	.063	.065	.062	.051
Memphis, Tenn.	29.617	.613	.607	.605	.610	.622	.631	.642	.649	.653	.654	.651	.638	.621	.606	.591	.582	.581	.582	.591	.597	.608	.613	.616	.616
New Orleans, La.	29.984	.978	.971	.973	.976	.984	.996	.003	.014	.015	.014	.010	.997	.985	.976	.966	.959	.960	.962	.967	.976	.985	.990	.993	.985
New York, N. Y.	29.727	.722	.719	.720	.725	.731	.741	.747	.744	.741	.738	.732	.722	.713	.704	.700	.697	.699	.701	.706	.717	.723	.728	.728	.722
Philadelphia, Pa.	29.927	.924	.922	.924	.933	.939	.948	.955	.957	.959	.953	.944	.929	.918	.904	.895	.892	.889	.900	.909	.921	.927	.928	.928	.926
Pittsburg, Pa.	29.178	.177	.178	.183	.189	.201	.209	.213	.212	.208	.200	.192	.179	.165	.154	.149	.141	.140	.143	.149	.158	.164	.168	.174	.176
Portland, Oreg.	29.859	.868	.876	.880	.882	.885	.889	.893	.898	.904	.905	.904	.897	.890	.880	.871	.859	.845	.831	.822	.817	.818	.825	.840	.868
St. Louis, Mo.	29.436	.435	.437	.434	.438	.445	.461	.473	.477	.478	.475	.472	.462	.451	.431	.418	.410	.405	.403	.404	.412	.421	.427	.430	.439
St. Paul, Minn.	29.098	.097	.095	.097	.100	.109	.118	.124	.128	.125	.121	.119	.111	.103	.093	.080	.072	.065	.059	.057	.061	.076	.085	.095	.095
Salt Lake City, Utah	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Diego, Cal.	29.838	.839	.834	.831	.825	.819	.818	.825	.836	.846	.855	.854	.858	.855	.848	.839	.829	.819	.812	.807	.802	.808	.816	.832	.831
San Francisco, Cal.	29.808	.808	.810	.804	.801	.799	.807	.815	.825	.834	.842	.844	.847	.844	.833	.824	.810	.797	.786	.781	.780	.785	.794	.805	.812
Savannah, Ga.	29.979	.976	.974	.976	.986	.995	.006	.016	.019	.020	.018	.009	.994	.978	.963	.955	.955	.955	.966	.970	.981	.989	.988	.987	.986
Washington, D. C.	29.932	.928	.928	.931	.941	.951	.959	.964	.966	.968	.967	.958	.942	.928	.917	.906	.902	.904	.907	.916	.926	.929	.930	.932	.935

TABLE VI.—*Average wind movement for each hour of seventy-fifth meridian time, July, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	6.7	6.7	6.8	7.3	7.4	7.8	7.7	7.2	7.3	9.9	10.9	10.7	10.7	10.5	10.2	10.4	11.0	10.5	10.6	10.4	9.5	7.6	7.9	6.9	8.9
Albany, N. Y.	5.3	4.9	4.6	4.4	4.3	4.6	5.8	7.0	7.3	7.2	8.1	9.1	9.7	9.5	9.2	9.0	8.5	8.1	6.9	5.6	5.4	6.1	6.3	5.6	6.8
Alpena, Mich.	6.1	6.2	6.0	5.8	5.4	5.3	5.6	6.6	8.1	8.6	9.4	10.5	11.1	11.5	12.1	12.5	12.1	10.8	9.7	7.5	6.3	5.6	5.5	5.5	8.1
Amarillo, Tex.	13.8	13.5	13.6	13.1	13.2	12.8	12.9	12.4	13.5	15.5	15.8	14.7	13.6	13.1	13.6	14.1	15.6	17.0	16.3	14.9	13.9	13.7	13.9	12.9	14.1
Atlanta, Ga.	6.7	6.8	6.5	6.4	7.0	6.5	6.7	7.3	7.5	7.7	7.9	8.4	8.7	9.0	8.7	8.5	9.1	9.1	8.3	7.4	6.8	6.8	6.8	7.1	7.6
Atlantic City, N. J.	8.5	8.2	7.8	7.5	7.9	8.3	8.7	8.9	9.1	9.4	10.1	10.7	11.5	11.7	11.6	11.5	10.9	10.2	9.3	8.6	9.0	9.0	8.8	8.3	9.4
Augusta, Ga.	3.6	4.1	3.7	3.8	3.5	3.5	3.7	4.4	6.1	6.3	6.9	7.1	7.6	8.4	9.5	8.3	8.2	7.6	6.8	5.9	5.8	5.3	4.1	3.9	5.8
Baker City, Oreg.	3.3	3.0	4.1	5.0	6.2	6.8	7.4	7.6	7.4	4.8	2.7	2.8	3.6	5.1	5.3	6.1	6.4	7.0	7.4	7.2	7.2	5.9	4.3	3.4	5.4
Baltimore, Md.	3.9	4.0	3.8	3.6	3.6	3.6	4.2	4.5	5.2	5.9	5.5	6.1	6.3	7.2	7.3	7.3	6.7	6.3	5.6	4.6	4.5	4.3	3.8	3.7	5.1
Bismarck, N. Dak.	7.3	7.3	6.8	6.3	6.6	6.6	7.1	7.0	8.1	9.5	10.6	11.1	12.0	12.7	12.0	11.9	13.5	13.3	12.5	11.4	8.7	7.1	6.9	6.7	9.3
Block Island, R. I.	9.7	9.1	9.4	9.7	10.1	11.2	11.3	11.7	11.3	11.5	11.8	12.2	13.6	13.3	13.2	13.5	13.6	13.3	11.6	10.7	11.6	11.3	10.5	9.6	11.5
Boston, Mass.	8.5	8.1	7.5	7.3	7.2	7.3	8.1	8.2	8.1	9.3	9.8	10.6	11.2	11.9	11.6	12.1	11.3	10.5	9.7	8.9	9.1	8.2	8.4	8.2	9.2
Buffalo, N. Y.	10.1	9.3	9.5	9.3	8.8	8.8	8.8	9.0	10.2	11.0	11.5	12.3	13.1	12.3	12.8	13.2	12.5	11.6	11.5	10.3	10.2	11.6	10.6	10.6	10.8
Cairo, Ill.	5.6	5.3	5.5	5.4	5.6	6.2	6.2	7.0	7.0	7.5	7.7	8.4	8.9	8.7	8.8	8.3	8.2	8.4	7.3	6.9	6.2	5.5	5.5	5.4	6.9
Cape Henry, Va.	11.6	11.7	11.3	10.8	11.0	10.9	11.3	11.8	11.5	11.8	12.0	12.2	13.2	12.9	13.5	13.9	12.9	11.7	11.5	11.6	11.0	11.0	11.7	10.8	11.8
Carson City, Nev.	6.9	5.6	5.1	4.2	3.5	2.9	3.0	2.6	2.0	1.4	1.8	3.9	5.5	6.8	8.9	10.6	12.4	13.7	13.8	13.3	12.2	10.0	8.2	7.5	6.9
Charleston, S. C.	7.8	7.9	8.3	7.9	7.5	7.9	8.5	9.0	9.4	9.7	10.2	10.5	11.1	11.9	12.7	12.6	12.8	13.0	11.6	10.5	10.3	10.0	9.0	8.4	9.9
Charlotte, N. C.	5.0	5.2	5.0	5.0	4.6	5.1	5.5	6.4	6.6	6.9	6.8	7.0	7.2	7.2	7.5	7.7	7.4	7.3	5.6	5.5	5.2	5.4	5.3	5.3	6.1
Chattanooga, Tenn.	4.3	4.7	4.4	4.3	4.0	3.9	3.6	4.6	6.1	6.9	7.1	7.2	8.1	8.1	7.7	9.1	9.1	8.5	7.5	6.1	4.7	4.3	4.4	4.5	6.0
Cheyenne, Wyo.	8.1	7.7	7.5	6.8	7.1	7.2	7.3	6.9	8.1	8.6	10.9	11.9	12.5	12.5	13.2	12.3	11.7	11.5	12.1	12.5	10.9	8.6	9.2	8.6	9.7
Chicago, Ill.	11.7	11.2	11.5	13.0	12.6	12.2	11.8	10.7	10.8	11.6	12.1	12.9	14.0	15.0	16.2	16.6	17.1	15.8	15.3	14.0	13.0	13.2	13.1	11.6	13.2
Cincinnati, Ohio	4.1	4.2	4.1	3.9	3.8	3.7	4.1	5.3	6.4	6.4	7.1	8.1	9.2	9.5	10.0	9.8	8.2	8.2	7.6	6.5	5.5	4.8	4.2	4.2	6.2
Cleveland, Ohio	10.6	10.5	10.6	10.7	11.0	10.6	9.8	10.3	9.8	10.6	11.8	12.1	12.7	13.6	13.9	14.0	13.7	12.1	11.5	10.5	10.4	10.2	9.9	10.0	11.3
Columbia, Mo.	5.2	5.1	5.2	5.1	5.4	5.8	5.6	5.4	5.9	7.0	7.1	7.4	7.5	8.1	8.2	8.1	7.5	6.9	6.2	5.0	4.4	5.0	5.2	5.8	6.2
Columbus, Ohio	5.7	5.2	4.6	4.4	4.5	4.5	4.7	5.6	6.0	6.4	7.1	7.7	7.8	8.0	8.2	8.6	8.1	8.2	8.1	6.4	6.0	6.1	6.0	6.1	6.4
Concordia, Kans.	5.8	5.3	4.7	4.6	4.6	4.3	4.1	5.0	6.1	7.4	7.5	7.7	7.9	8.7	8.6	8.6	8.6	8.4	7.7	6.3	5.1	4.6	4.5	4.6	6.3
Corpus Christi, Tex.	12.0	10.3	8.9	7.5	7.1	6.3	5.7	6.4	8.0	9.6	9.8	10.5	13.0	14.7	16.5	17.5	17.9	18.1	18.5	18.2	17.7	17.0	15.3	13.5	12.5
Davenport, Iowa.	4.8	4.1	4.1	4.2	4.2	4.3	4.8	5.1	6.1	6.5	7.0	7.2	8.1	8.7	8.7	8.7	8.9	8.0	7.9	6.5	5.2	4.7	4.9	4.9	6.2
Denver, Colo.	8.3	7.6	7.5	7.3	7.3	6.1	5.8	6.0	5.9	6.1	7.1	6.7	6.8	7.5	8.5	9.5	10.1	10.5	9.2	9.9	9.4	9.3	9.1	8.3	7.9
Des Moines, Iowa.	2.8	2.8	2.8	3.3	3.3	3.0	2.9	3.4	4.4	5.5	6.5	6.9	7.4	7.7	8.0	7.8	7.3	7.0	6.1	4.9	3.9	3.1	3.3	2.8	4.9
Detroit, Mich.	5.4	5.3	5.4	5.3	5.4	5.0	4.7	4.7	5.7	6.6	7.1	7.5	8.1	8.3	8.6	8.2	8.1	7.0	6.5	5.6	5.5	5.5	5.0	5.1	6.2
Dodge, Kans.	9.3	9.4	9.3	8.7	8.1	7.4	7.0	6.3	9.8	11.9	12.3	12.4	12.6	12.8	12.8	13.4	13.2	13.0	12.7	12.2	10.5	8.5	8.1	8.4	10.4
Dubuque, Iowa.	3.4	3.3	3.5	3.5	3.3	3.3	3.3	4.2	5.1	5.7	7.1	8.0	8.6	9.0	8.7	8.5	9.2	8.2	7.4	6.2	5.2	4.6	3.5	3.3	5.7
Duluth, Minn.	8.3	7.9	7.5	7.0	8.3	8.2	8.5	8.3	8.4	8.9	9.5	9.6	10.7	10.9	11.5	11.5	11.3	10.8	10.0	9.3	9.3	7.9	8.5	8.8	9.2
Eastport, Me.	6.5	6.9	6.3	6.8	6.9	6.9	6.2	6.1	6.7	6.0	6.6	7.6	8.4	8.9	9.6	10.1	9.8	9.5	8.3	7.5	7.6	7.2	6.2	6.0	7.5
El Paso, Tex.	8.7	8.4	9.5	9.1	9.3	10.0	11.3	10.8	9.7	9.5	9.6	9.3	8.8	8.9	8.8	10.0	10.0	10.6	10.6	10.1	9.5	9.7	8.8	9.6	9.6
Erie Pa.	8.0	8.2	8.7	8.4	8.2	8.3	8.6	9.1	8.8	9.4	9.9	9.8	10.2	10.7	9.6	9.6	9.4	8.6	8.0	6.7	6.6	6.6	6.6	7.1	8.6
Eureka, Cal.	5.7	4.9	4.3	4.5	4.0	4.1	3.9	4.0	3.6	3.4	4.3	4.4	5.5	6.5	8.0	9.1	9.1	9.7	10.7	11.1	10.2	8.9	7.6	5.9	6.4
Evansville, Ind.	4.3	5.0	4.7	4.7	4.9	5.2	5.2	5.6	6.4	7.3	8.2	8.6	8.7	8.6	8.5	8.2	8.0	7.7	7.1	5.6	5.2	4.4	4.3	4.2	6.3
Fort Canby, Wash.	9.2	8.5	8.6	8.6	8.6	8.1	8.2	7.8	8.7	8.2	7.5	7.3	7.9	7.7	8.6	8.8	9.8	9.8	10.4	10.1	10.3	9.8	10.4	9.8	8.9
Fort Smith, Ark.	3.8	3.7	3.9	4.0	3.8	4.0	3.6	4.3	4.8	5.3	5.7	5.9	6.2	6.5	7.3	7.2	7.3	6.7	6.3	5.6	4.2	5.0	5.0	3.9	5.2
Fresno, Cal.	10.4	10.0	9.9	8.7	7.4	6.6	6.2	4.9	4.6	4.3	4.6	4.7	5.2	5.0	5.6	5.8	6.3	6.5	6.4	6.1	6.2	6.9	6.9	7.0	7.7
Galveston, Tex.	6.3	6.6	6.6	6.4	6.4	5.6	5.7	5.7	6.2	6.8	7.0	6.8	7.1	7.6	7.6	7.4	7.0	6.5	6.3	5.7	5.5	5.5	5.4	5.7	6.4
Grand Haven, Mich.	6.4	6.6	6.4	6.1	5.7	5.9	6.0	6.9	7.4	7.6	8.7	9.5	11.1	11.5	11.7	11.0	10.8	9.7	8.3	7.2	5.9	5.8	5.9	5.8	7.8
Green Bay, Wis.	4.7	4.7	5.5	5.4	5.2	4.7	4.6	5.5	6.5	6.8	7.6	8.0	8.0	8.5	8.8	8.8	8.5	7.8	7.2	6.5	5.5	5.8	5.3	5.0	6.5
Hannibal, Mo.	6.2	6.1	6.0	5.7	5.8	5.9	5.5	6.1	7.0	8.2	8.4	8.7	9.4	9.8	9.6	9.5	9.3	8.9	8.3	6.7	4.8	5.0	5.1	5.7	7.2
Harrisburg, Pa.	4.2	3.9	3.8	3.4	3.3	3.2	3.8	5.0	5.5	6.1	6.8	7.0	7.2	7.5	8.3	8.0	7.6	7.2	6.6	6.1	5.5	5.4	5.3	4.8	5.6
Hatteras, N. C.	10.0	9.8	9.2	9.0	9.1	9.0	9.5	10.8	10.6	11.0	11.1	11.6	12.4	12.6	13.4	13.0	12.9	12.6	12.0	11.1	10.5	10.3	10.5	10.5	10.9
Havre, Mont.	7.9	7.8	7.4	7.7	8.2	7.8	6.8	7.3	8.2	9.5	10.5	10.3	12.4	13.2	13.0	12.9	14.1	14.3	14.4	14.0	13.6	11.0	9.2	9.0	10.4
Helena, Mont.	8.6	8.4	8.5	8.1	7.5	8.0	7.5	7.2	5.9	6.5	7.0	7.5	7.2	7.4	7.9	8.1	8.7	9.5	9.3	8.9	7.9	7.3	9.1	9.1	8.0
Huron, S. Dak.	10.0	9.5	8.9	9.0	9.5	9.5	9.7	10.0	11.9	12.8	13.9	14.0	14.1	14.5	15.0	14.6	14.0	14.1	13.6	12.1	11.2	10.6	10.6	10.9	11.8
Idaho Falls, Idaho.	9.3	8.5	7.8	8.0	8.0	8.4	7.8	7.6	7.2	8.0	10.1	11.7	13.1	13.8	14.6	15.4	16.0	17.5	18.3	17.2	15.3	12.9	11.0	9.9	11.6
Independence, Cal.	8.7	7.7	7.0	6.5	6.4	5.4	5.7	5.4	5.8	6.3	6.7	7.5	7.8	8.0	9.9	11.1	12.0	12.4	12.8	12.9	13.4	11.5	9.2	8.5	8.7
Indianapolis, Ind.	7.4	7.0	6.2	5.9	6.7	6.1	6.5	6.2	7.0	7.5	8.9	10.0	9.8	9.5	8.9	9.4	9.6	9.8	9.5	9.1	7.3	6.8	6.9	7.2	7.9
Jacksonville, Fla.	7.5	6.9	6.5	6.1	6.2	5.4	5.2	5.7	6.3	6.6	6.6	6.5	7.5	7.8	8.7	9.3	9.2	9.5	9.7	7.6	7.4	7.7	7.2	6.5	7.2
Jupiter, Fla.	7.4	6.5	6.5	6.7	6.0	5.9	5.8	6.5	7.5	9.1	9.9	11.0	11.6	12.8	12.5	13.2	12.0	11.0	10.1	8.7	8.6	8.3	8.6	8.1	8.9
Kansas City, Mo.	6.3	6.4	6.4	6.2	6.3	5.8	6.0	6.4	7.2	8.0	8.5	8.5	9.0	9.3	9.1	9.2	9.2	8.8	8.5	7.3	6.2	6.1	6.5	6.4	7.4
Keokuk, Iowa.	4.7	5.6	4.5	4.5	4.6	4.5	4.5	5.4	6.0	6.5	6.7	6.9	7.4	7.8	7.5	7.5	7.5	6.8	6.6	5.5	4.5	4.8	4.5	4.5	5.8
Key West, Fla.	7.1	7.1	6.9	6.5	6.5	6.1	6.3	7.6	8.8	9.1	8.9	9.5	9.3	9.5	9.3	9.1	8.9	8.3	8.1	7.1	7.5	7.4	7.3	7.1	7.9
Kittyhawk, N. C.	12.9	12.2	10.9	11.6	11.9	11.6	11.8	12.3	12.8	12.5	12.6	12.2	13.0	14.3	14.1	14.8	15.5	15.4	14.5	14.3	14.2	14.7	13.7	13.2	13.2
Knoxville, Tenn.	5.0	5.1	4.7	4.2	4.3	4.6	4.6	5.3	6.7	7.5	7.9	8.0	8.9	8.1	8.4	9.5	8.6	7.6	8.0	6.5	6.4	5.5	5.2	5.4	6.5
La Crosse, Wis.	3.7	3.9	3.8	4.1	4.0	4.2	4.6	5.1	5.3	5.2	5.6	6.4	7.8	8.4	8.4	8.5	8.4	8.0	7.3	6.3	4.8	4.4	3.9	3.5	5.7
Lander, Wyo.	4.9	4.3	3.8	3.4	3.2	3.0	3.1	2.5	2.2	2.8	3.3	3.8	4.5	4.9	5.7	6.5	7.9	7.9	7.4	6.9	6.1	5.1	5.9	5.4	4.8
Lexington Ky.	6.4	6.3	6.6	6.4	6.5	6.5	6.0	7.0	7.7	7.5	8.6	9.1	9.2	9.1	8.7	9.2	8.9	8.4	7.1	5.5	6.3	6.7	6.3	6.4	7.3
Little Rock, Ark.	4.8	4.5	4.4	4.6	4.7	4.1	4.6	5.1	6.1	6.6	6.9	7.3	8.2	8.4	8.8	9.2	10.3	9.6	8.6	7.5	6.4	6.3	5.5	4.7	6.5
Los Angeles, Cal.	3.2	2.6	2.4	2.0	2.0	1.8	1.4	1.5	1.4	2.1	2.6	3.3	4.4	5.0	6.7	8.2	8.7	8.8	9.1	8.6	7.2	5.9	4.6	3.7	4.5
Louisville, Ky.	4.1	4.6	4.9	4.6	5.0	5.3	5.2	5.8	6.6	7.2	8.7	8.9	9.8	9.8	9.4	9.5	9.1	8.4	8.2	7.0	6.1	5.1	4.6	4.3	6.8
Lynchburg, Va.	2.0	1.7	1.8	1.8	1.8	1.8	2.3	3.2	3.9	4.7	4.6	4.6	4.7	5.1	5.2	5.1	5.3	4.6	4.3	3.4	2.6	2.4	2.0	1.8	3.4
Marquette, Mich.	9.3	9.2	9.6	8.6	9.1	9.3	9.0	9.3	9.8	10.1	10.3	9.7	10.6	10.6	10.7	11.1	10.6	10.0	8.3	7.2	6.4	7.6	8.7	9.5	9.4
Memphis, Tenn.	6.2	6.0	6.1	6.5	6.7	6.9	6.2	6.8	7.8	8.1	8.2	8.3	9.0	9.2	9.5	9.8	9.5	9.5	9.6	7.8	6.4	6.6	6.7	6.5	7.7
Milwaukee, Wis.	6.4	6.2	6.1	5.5	5.9	6.3	6.7	6.6	7.1	7.6	8.7	9.5	11.1	11.1	11.3	10.6	9.9	9.4	9.0	7.2	5.6	5.4	5.3	5.5	7.7
Mobile, Ala.	5.5	5.4	5.2	5.0	5.4	4.6	4.8	5.1	5.9	6.4	7.0	8.1	9.2	9.9	9.9	10.1	9.3	8.5	7.6	6.5	5.6	5.6	5.4	5.0	6.7
Montgomery, Ala.	4.6	4.7	4.8	4.0	3.8	3.9	3.8	5.0	5.9	6.5	6.5	7.2	7.7	7.8	8.1	8.7	8.6	8.1	6.0	5.5	5.5	4.9	5.0	4.5	5.9
Moorhead, Minn.	7.7	7.3	7.2	6.7	6.9	6.9	6.8	7.3	7.6	8.7	9.3	9.6	10.3	10.8	11.2	11.5	12.1	11.3	10.6	9.2	7.9	7.6	8.1	7.6	8.8
Nantucket, Mass.	7.7	7.9	8.1	8.3	7.8	7.9	7.8	8.8	9.0	9.5	9.9	10.4	10.1	10.1	9.8	9.9	9.7	9.2	8.3	7.6	7.7	7.7	7.9	8.0	8.7
Nashville, Tenn.	3.4	3.3	3.1	3.5	3.1	3.3	3.1	4.1	5.6	5.9	6.6	7.0	7.2	7.2	8.4	8.5	8.7	7.8	7.4	6.8	5.2	4.9	4.0	4.0	5.5
New Haven, Conn.	5.5	5.1	5.2	5.3	5.5	5.2	6.0	6.8	7.5	8.1	8.9	9.7	10.5	11.4	11.4	11.0	10.3	8.9	8.0	7.0	7.1	6.2	5.7	5.5	7.6
New Orleans, La.	6.1	5.6	5.7	5.3	5.6	5.4	5.1	5.9	7.7	8.4	8.5	9.2	9.4	10.0	10.1	9.1	8.7	8.2	7.6	6.8	6.2	6.4	6.4	6.2	7.2
New York, N. Y.	8.0	7.8	7.8	8.1	7.3	7.2	8.0	8.0	8.5	7.9	8.1	9.2	9.5	9.9	9.7	10.0	10.2	9.9	9.8	9.2	8.6	8.6	8.3	7.7	8.6
Norfolk, Va.	6.3	6.4	6.5	6.5	6.0	5.9	6.3	7.1	7.3	7.2	7.8	7.6	8.5	8.8	9.5	9.3	8.7	7.5	7.0	6.9	6.9	7.0	6.5	6.2	7.2
Northfield, Vt.	6.8	6.6	5.6	5.7	5.4	4.9	4.3	5.8	7.5	9.7	10.3	10.8	10.7	11.0	11.4	11.5	10.9	9.0	7.3	5.9	6.7	6.4	6.8	6.4	7.8
North Platte, Nebr.	9.2	7.9	7.3	6.9	6.8	6.3	6.0	5.5	7.1	8.6	9.3	10.3	11.3	12.0	12.2	12.4	12.0	11.4	10.8	9.6	8.1	7.1	7.0	7.5	8.9
Oklahoma, Okla.	6.8	7.0	6.5	6.9	7.1	6.7	6.5	7.2	8.8	9.6	10.0	10.2	10.1	10.6	11.0	11.2	10.7	10.9	11.3	9.6	7.2	6.5	7.2	7.2	8.6
Omaha, Nebr.	5.7	5.9	5.7	5.4	5.3	4.9	5.0	5.8	6.8	7.9	8.3	9.1	9.7	10.1	10.0	10.1	10.1	10.0	8.8	7.7	6.1	5.2	5.4	5.2	7.3
Oswego, N. Y.	7.9	7.7	7.6	7.2	7.2	7.2	8.0	8.7	8.5	8.5	8.6	8.6	8.7	9.0	9.0	8.5	7.7	7.1	6.4	6.1	6.2	6.9	6.9	7.0	7.7

TABLE VI.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Palestine, Tex	4.7	4.8	4.5	4.3	4.4	4.3	4.1	4.4	6.1	7.3	7.2	6.6	6.7	6.9	7.4	7.6	7.5	6.7	6.5	5.5	4.1	4.1	3.9	4.3	5.6
Parkersburg, W. Va	3.1	2.9	2.9	3.2	3.1	3.4	3.3	3.7	4.5	4.9	5.5	5.7	6.7	6.5	6.7	6.8	6.3	5.7	5.0	4.0	3.8	3.8	3.7	3.4	4.5
Pensacola, Fla	8.2	8.6	8.7	9.1	8.5	7.4	7.3	6.9	7.6	8.1	8.6	9.0	10.1	11.1	11.2	11.3	11.4	11.3	10.0	9.1	7.7	7.5	8.0	8.4	9.0
Philadelphia, Pa	7.2	7.2	7.1	7.4	7.3	7.3	7.5	8.1	8.2	8.1	8.5	8.9	9.0	9.6	10.1	10.5	10.2	10.3	10.1	10.1	8.7	8.4	7.6	7.2	8.5
Phenix, Ariz	5.1	5.2	4.5	4.6	4.7	3.9	3.9	3.5	3.4	3.7	4.5	5.1	4.8	5.1	5.0	5.3	6.0	5.6	5.4	4.8	4.6	4.2	4.4	5.0	4.7
Pierre, S. Dak	9.9	8.5	7.4	7.3	7.5	7.5	7.1	7.2	8.2	9.4	11.1	11.3	12.5	12.5	13.3	12.6	12.8	13.6	14.1	14.4	13.4	11.3	10.4	9.6	10.5
Pittsburg, Pa	3.4	3.3	3.0	2.9	2.9	3.4	3.7	4.4	5.1	5.3	5.7	5.6	6.6	6.9	7.5	7.1	7.1	7.1	5.9	5.3	5.1	4.7	4.0	3.7	5.0
Port Angeles, Wash	6.0	5.7	6.0	5.7	5.4	5.3	5.1	5.2	4.9	4.3	5.4	7.2	8.5	8.7	9.1	10.9	11.8	12.5	13.5	13.1	12.8	10.8	8.1	6.2	8.0
Port Huron, Mich	7.5	7.0	6.6	6.3	6.4	6.9	6.3	7.0	7.6	8.0	9.1	10.0	11.0	11.6	10.9	11.4	10.2	9.6	9.1	7.9	7.1	7.1	7.3	7.2	8.3
Portland, Me	5.1	5.2	5.5	5.3	4.8	5.0	5.4	5.4	6.0	7.4	8.2	8.6	9.4	10.1	10.3	10.3	9.9	8.6	7.5	7.1	5.9	5.9	5.7	5.7	7.0
Portland, Oreg	8.9	8.1	6.9	6.6	6.1	5.5	5.7	5.1	4.8	6.0	7.6	7.8	7.7	7.5	7.7	7.5	8.1	8.7	9.5	9.5	10.2	10.0	9.5	9.6	7.7
Pueblo, Colo	7.4	6.9	6.2	5.7	5.0	5.1	4.7	4.0	4.7	4.9	6.1	7.2	8.2	9.2	9.3	9.6	10.6	10.6	12.2	12.6	10.5	10.5	9.5	7.5	7.9
Raleigh, N. C	4.3	4.3	4.5	4.3	4.5	4.3	4.9	5.8	6.1	6.4	6.3	6.6	7.3	7.0	7.0	6.9	6.8	6.8	5.7	4.9	5.1	5.1	4.8	4.7	5.6
Rapid City, S. Dak	6.7	7.2	6.3	6.0	6.3	5.0	5.4	5.7	6.4	6.6	8.3	9.6	10.7	10.2	9.7	9.6	9.5	9.3	9.8	9.4	8.6	6.7	6.1	6.2	7.7
Red Bluff, Cal	6.0	5.6	5.4	4.5	5.3	4.7	4.1	3.9	3.6	3.7	4.9	5.3	5.5	5.3	5.4	5.9	6.5	6.9	6.9	7.0	6.7	6.2	5.5	5.5	5.4
Richmond, Va	4.5	5.0	4.3	4.5	4.7	4.4	5.1	5.6	6.6	6.8	7.1	7.3	7.0	7.5	7.4	7.5	7.4	7.5	6.5	6.1	5.7	4.7	4.7	4.8	5.9
Rochester, N. Y	5.9	5.8	5.6	5.0	4.9	5.4	6.0	6.5	6.9	7.1	7.8	7.8	9.0	9.2	10.0	9.2	8.8	7.7	6.5	5.1	4.9	4.9	5.2	5.2	6.7
Roseburg, Oreg	2.8	2.1	2.2	2.1	2.2	2.0	1.9	2.2	1.7	2.2	2.5	3.3	3.9	4.1	4.9	5.5	6.8	7.7	8.7	9.1	9.3	9.2	7.1	4.1	4.5
Sacramento, Cal	10.5	10.2	10.5	10.9	10.7	10.1	9.8	9.7	8.8	8.5	8.1	7.5	7.2	7.7	8.0	8.6	9.5	10.3	11.4	11.8	11.4	11.2	11.5	10.7	9.8
St. Louis, Mo	7.3	7.5	8.0	7.2	7.1	6.5	6.3	7.5	6.9	7.4	8.5	8.7	9.0	9.1	9.9	9.4	9.6	9.5	8.7	7.6	6.6	6.5	6.3	7.1	7.8
St. Paul, Minn	5.5	5.5	5.4	5.2	5.2	5.0	4.6	5.6	6.4	7.7	8.4	8.6	9.4	9.7	9.6	9.8	9.2	9.1	8.5	7.6	5.8	5.0	5.0	4.9	7.0
Salt Lake City, Utah	4.6	5.5	5.2	4.5	5.2	4.6	4.5	4.7	4.0	3.6	4.7	5.5	7.1	7.5	7.9	7.9	8.0	8.2	7.6	7.1	5.7	5.7	5.9	4.4	5.8
San Antonio, Tex	9.1	7.5	6.2	5.5	5.3	5.0	4.9	5.2	6.6	8.2	8.0	7.9	7.5	8.2	8.8	8.9	10.1	10.1	10.9	11.3	10.7	11.0	10.8	10.1	8.3
San Diego, Cal	3.4	3.4	3.2	2.9	3.2	3.1	3.2	3.1	3.4	4.0	4.7	6.7	7.9	9.5	10.6	11.0	11.3	10.9	10.4	9.6	8.1	6.7	5.5	4.4	6.3
Sandusky, Ohio	7.0	6.5	6.6	6.2	6.3	6.2	5.7	6.1	6.9	8.0	7.6	7.8	8.2	8.5	8.7	9.3	9.0	8.4	7.4	6.4	6.6	6.9	6.2	6.7	7.2
San Francisco, Cal	15.9	13.5	11.3	10.7	10.8	9.8	9.7	8.7	8.8	9.7	10.4	10.7	12.1	14.6	17.5	20.6	23.8	24.8	26.3	26.1	24.5	22.6	19.4	16.6	15.8
San Luis Obispo, Cal	2.5	2.2	2.4	2.8	3.1	2.6	2.6	2.5	2.7	3.1	3.6	3.9	4.7	5.9	6.6	7.0	7.4	6.7	6.4	6.1	5.5	4.8	4.1	2.9	4.3
Santa Fe, N. Mex	7.2	5.2	4.0	3.9	3.1	2.5	1.8	1.7	2.4	3.3	4.2	5.0	6.3	7.2	7.7	8.5	8.0	7.2	7.9	8.9	8.9	7.4	7.5	7.8	5.7
Sault Ste. Marie, Mich	5.2	5.8	5.0	5.1	5.0	4.9	5.0	6.2	6.6	8.3	8.7	9.2	10.2	11.2	11.9	12.0	11.8	11.0	9.4	8.8	8.0	6.3	6.0	5.7	7.8
Savannah, Ga	6.3	5.9	6.0	5.2	5.6	5.3	5.6	6.5	7.1	7.3	7.6	7.4	8.1	8.7	8.9	9.4	9.7	9.6	8.6	7.4	7.0	6.2	6.5	5.9	7.2
Seattle, Wash	3.2	2.9	2.6	2.8	2.7	2.5	2.7	2.6	2.6	2.9	3.7	4.2	4.9	5.7	6.1	5.9	6.7	6.9	7.1	7.0	6.6	5.8	4.9	3.9	4.5
Shreveport, La	4.9	4.7	4.6	4.1	3.9	3.9	3.8	4.1	5.1	5.7	6.1	6.2	6.5	6.7	6.5	6.8	7.6	7.4	6.7	5.9	5.4	5.2	5.0	5.3	5.5
Sioux City, Iowa	9.5	9.2	10.1	10.0	10.0	9.1	9.4	9.3	9.5	10.9	11.0	12.5	12.6	12.7	12.4	12.6	12.8	12.2	11.3	10.5	9.3	9.6	9.5	9.1	10.6
Spokane, Wash	4.9	4.5	4.0	4.4	4.5	4.5	4.2	4.5	4.7	4.8	5.8	6.6	7.1	7.2	7.9	8.0	7.9	8.5	8.2	8.9	8.3	7.8	5.6	5.1	6.4
Springfield, Ill	6.0	5.5	5.2	4.9	4.5	4.8	5.2	6.1	6.3	6.4	7.3	7.7	8.3	8.9	8.9	8.8	8.2	7.9	7.4	5.7	5.0	5.4	5.9	5.9	6.5
Springfield, Mo	7.5	8.3	7.6	7.1	7.1	7.1	7.6	7.5	8.3	8.6	9.4	8.9	9.1	8.9	8.9	9.0	10.2	9.7	9.3	8.1	7.2	7.5	7.7	7.5	8.3
Tacoma, Wash	6.6	5.6	4.7	4.5	3.8	3.6	3.3	3.3	2.9	3.7	4.6	5.7	6.5	7.3	7.7	7.2	7.4	7.1	6.9	7.2	7.2	6.8	7.0	7.0	5.7
Tampa, Fla	5.0	4.5	5.0	4.5	4.4	4.1	5.1	5.6	6.3	6.5	6.8	6.7	8.4	7.5	7.7	7.4	8.3	8.0	7.1	6.2	5.4	4.7	4.1	4.0	6.0
Toledo, Ohio	7.7	6.5	6.4	6.7	6.5	6.1	6.0	7.0	8.2	8.2	9.1	10.2	10.1	10.7	10.5	10.4	10.4	9.7	9.0	7.3	6.5	7.3	6.9	6.9	8.1
Vicksburg, Miss	5.1	4.8	4.6	4.7	4.8	4.8	4.4	4.7	5.4	5.3	5.7	5.8	5.8	6.2	6.7	6.9	6.6	6.5	5.9	5.3	5.0	4.7	4.8	5.5	5.4
Vineyard Haven, Mass	6.9	6.5	6.2	6.1	6.2	6.4	7.1	7.5	7.8	8.4	8.2	8.5	8.9	8.5	8.7	8.5	8.2	7.6	6.8	6.3	6.7	7.2	7.1	6.7	7.4
Walla Walla, Wash	5.8	5.7	5.3	4.8	5.4	5.4	5.1	4.8	4.7	4.7	5.1	6.1	5.7	6.0	5.9	6.3	6.1	6.4	6.4	5.7	6.7	5.7	5.3	5.7	5.6
Washington, D. C	3.6	4.0	3.5	3.8	3.5	3.3	3.6	4.7	5.6	6.2	6.4	6.5	6.7	7.2	7.7	7.7	7.6	7.6	6.0	5.0	4.3	4.3	3.8	3.5	5.3
Wichita, Kans	6.2	6.1	6.1	6.4	6.1	6.0	5.7	5.8	6.4	6.9	7.3	8.1	9.1	9.0	9.5	9.0	9.2	8.9	8.4	7.4	6.5	5.8	6.2	6.0	7.2
Williston, N. Dak	5.5	5.7	5.8	5.2	5.2	4.6	4.7	4.9	5.0	6.3	7.6	7.1	8.9	9.8	9.9	10.0	11.1	11.3	10.6	10.4	9.4	7.2	5.7	5.6	7.4
Wilmington, N. C	5.5	5.5	5.5	5.6	5.1	5.3	5.5	6.4	6.7	6.8	7.9	8.0	9.0	9.7	9.9	9.8	9.9	8.8	8.0	7.3	6.0	6.4	6.0	5.7	7.1
Winnemucca, Nev	8.3	8.8	8.4	8.0	7.8	7.6	7.9	7.1	6.9	6.8	7.2	8.4	9.6	10.2	10.5	11.7	13.1	13.1	13.2	12.5	11.9	10.3	7.2	7.9	9.4
Woods Hole, Mass	9.6	9.6	9.2	9.7	9.6	9.7	10.4	10.4	10.5	9.8	9.9	10.4	11.3	11.8	12.2	12.3	11.7	10.7	9.7	10.0	9.7	9.7	10.4	10.1	10.4
Yankton, S. Dak	7.0	7.3	6.2	6.2	6.0	6.4	5.9	5.9	7.1	8.0	8.8	9.3	9.9	10.5	10.4	10.6	10.8	10.8	10.4	8.9	7.0	7.3	6.9	6.7	8.1

TABLE VII.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of July, 1898.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	20	32	4	12	s. 34 w.	14
Portland, Me	18	29	10	21	s. 45 w.	16
Northfield, Vt	16	39	5	9	s. 10 w.	23
Boston, Mass	17	19	15	23	s. 76 w.	8
Nantucket, Mass	9	28	18	26	s. 23 w.	21
Woods Hole, Mass.*	3	30	10	5	s. 16 e.	18
Block Island, R. I	13	23	17	23	s. 31 w.	12
New Haven, Conn	20	24	18	9	s. 66 e.	10
Middle Atlantic States.						
Albany, N. Y	19	30	10	12	s. 10 w.	11
Binghamton, N. Y.†	11	5	11	10	n. 9 e.	6
New York, N. Y	17	23	21	16	s. 40 e.	8
Harrisburg, Pa.†	11	5	7	12	n. 40 w.	8
Philadelphia, Pa	14	21	22	20	s. 16 e.	7
Atlantic City, N. J	8	26	24	18	s. 18 e.	19
Cape May, N. J	11	31	24	8	s. 39 e.	26
Baltimore, Md	21	22	23	12	s. 85 e.	11
Washington, D. C	21	25	15	11	s. 45 e.	6
Lynchburg, Va	22	14	26	16	n. 51 e.	13
Norfolk, Va	12	23	28	17	s. 45 e.	16
South Atlantic States.						
Richmond, Va	22	24	18	8	s. 79 e.	10
Charlotte, N. C	13	21	31	10	s. 69 e.	22
Hatteras, N. C	16	32	13	11	s. 7 e.	16
Raleigh, N. C	22	19	18	22	n. 53 w.	5
Wilmington, N. C	15	21	17	25	s. 53 w.	10
Charleston, S. C	11	25	17	25	s. 28 w.	17
Augusta, Ga	10	27	16	22	s. 19 w.	18
Savannah, Ga	10	34	9	21	s. 27 w.	27
Jacksonville, Fla	6	37	20	12	s. 14 e.	32
Florida Peninsula.						
Jupiter, Fla	2	33	32	8	s. 38 e.	39
Key West, Fla	0	23	46	2	s. 62 e.	50
Tampa, Fla	12	18	37	8	s. 78 e.	30
Eastern Gulf States.						
Atlanta, Ga	10	25	22	21	s. 4 e.	15
Pensacola, Fla	18	27	14	22	s. 42 w.	12
Mobile, Ala	23	22	8	18	n. 84 w.	10
Montgomery, Ala	9	30	12	25	s. 31 w.	25
Vicksburg, Miss	12	20	29	12	s. 65 e.	19
New Orleans, La	15	26	13	18	s. 24 w.	12
Western Gulf States.						
Shreveport, La	13	28	33	8	s. 59 e.	29
Fort Smith, Ark	11	10	43	5	n. 88 e.	38
Little Rock, Ark	17	30	18	8	s. 38 e.	16
Corpus Christi, Tex	5	40	29	5	s. 34 e.	42
Galveston, Tex	8	40	15	12	s. 5 e.	32
Palestine, Tex	14	36	16	7	s. 22 e.	24
San Antonio, Tex	14	30	34	3	s. 63 e.	35
Ohio Valley and Tennessee.						
Chattanooga, Tenn	17	30	18	14	s. 17 e.	14
Knoxville, Tenn	21	22	14	20	s. 9 w.	6
Memphis, Tenn	20	25	18	15	s. 31 e.	6
Nashville, Tenn	18	22	18	19	s. 14 w.	4
Lexington, Ky	10	25	22	17	s. 18 e.	16
Louisville, Ky	19	26	14	10	s. 30 e.	8
Evansville, Ind.†	9	15	11	3	s. 53 e.	10
Indianapolis, Ind	22	22	16	18	w.	2
Cincinnati, Ohio	20	23	23	12	s. 75 e.	11
Columbus, Ohio	16	22	20	20	s.	6
Pittsburg, Pa	12	22	16	20	s. 22 w.	11
Parkersburg, W. Va	12	25	26	11	s. 49 e.	20
Lower Lake Region.						
Buffalo, N. Y	13	22	18	25	s. 38 w.	11
Oswego, N. Y	15	29	11	20	s. 33 w.	17
Rochester, N. Y	13	28	11	31	s. 53 w.	25
Erie, Pa	16	24	14	19	s. 32 w.	9
Cleveland, Ohio	23	22	25	7	n. 87 e.	18
Sandusky, Ohio	12	22	28	13	s. 56 e.	18
Toledo, Ohio	17	14	29	16	n. 77 e.	13
Detroit, Mich	21	18	22	20	n. 34 e.	4
Upper Lake Region.						
Alpena, Mich	24	18	17	21	n. 34 w.	7
Grand Haven, Mich	27	15	13	24	n. 43 w.	16
Marquette, Mich	22	22	12	23	w.	11
Port Huron, Mich	27	22	22	6	n. 73 e.	17
Sault Ste. Marie, Mich	19	11	19	26	n. 41 w.	11
Chicago, Ill	24	16	24	14	n. 51 e.	13
Upper Lake Region—Cont'd.						
Milwaukee, Wis	21	19	26	13	n. 81 e.	13
Green Bay, Wis	11	29	23	11	s. 34 e.	22
Duluth, Minn	31	7	21	23	n. 5 w.	24
North Dakota.						
Moorhead, Minn	20	23	22	17	s. 59 e.	6
Bismarck, N. Dak	20	14	21	20	n. 9 e.	6
Williston, N. Dak	22	22	12	17	w.	5
Upper Mississippi Valley.						
St. Paul, Minn	15	27	16	20	s. 18 w.	13
La Crosse, Wis.†	7	19	6	3	s. 14 e.	12
Davenport, Iowa	20	20	23	15	e.	8
Des Moines, Iowa	17	29	13	11	s. 9 e.	12
Dubuque, Iowa	19	25	15	18	s. 27 w.	7
Keokuk, Iowa	21	22	16	11	s. 79 e.	5
Cairo, Ill	20	27	18	10	s. 49 e.	11
Springfield, Ill	13	26	20	10	s. 38 e.	16
Hannibal, Mo.†	9	11	10	7	s. 56 e.	4
St. Louis, Mo	18	27	19	9	s. 48 e.	14
Missouri Valley.						
Columbia, Mo.*	7	13	15	2	s. 65 e.	14
Kansas City, Mo	24	23	30	3	n. 2 e.	27
Springfield, Mo	13	30	26	8	s. 47 e.	25
Lincoln, Nebr	14	28	30	3	s. 63 e.	30
Omaha, Nebr	21	28	23	7	s. 66 e.	18
Sioux City, Iowa†	7	15	9	5	s. 27 e.	9
Pierre, S. Dak	18	23	30	6	s. 78 e.	24
Huron, S. Dak	17	33	17	8	s. 29 e.	18
Yankton, S. Dak†	7	13	7	7	s.	6
Northern Slope.						
Havre, Mont	16	15	15	26	n. 85 w.	11
Miles City, Mont	25	13	5	22	n. 55 w.	21
Helena, Mont	14	24	9	35	s. 69 w.	28
Rapid City, S. Dak	17	14	19	26	n. 67 w.	8
Cheyenne, Wyo	19	25	7	24	s. 71 w.	18
Lander, Wyo	17	21	15	26	s. 70 w.	12
North Platte, Nebr	15	33	15	14	s. 3 e.	18
Middle Slope.						
Denver, Colo	17	28	11	22	s. 45 w.	16
Pueblo, Colo	27	9	18	19	n. 3 w.	18
Concordia, Kans	12	28	27	4	s. 55 e.	28
Dodge, Kans	9	40	25	4	s. 34 e.	37
Wichita, Kans	12	33	23	5	s. 41 e.	28
Oklahoma, Okla	11	29	28	3	s. 54 e.	31
Southern Slope.						
Abilene, Tex	9	40	23	4	s. 31 e.	36
Amarillo, Tex	9	40	12	4	s. 14 e.	32
Southern Plateau.						
El Paso, Tex	23	11	39	8	n. 69 e.	33
Santa Fe, N. Mex	16	27	21	8	s. 50 e.	17
Phenix, Ariz	20	8	19	26	n. 30 w.	14
Yuma, Ariz	5	27	9	31	s. 45 w.	31
Independence, Cal	20	22	16	22	s. 72 w.	6
Middle Plateau.						
Carson City, Nev	7	19	5	40	s. 71 w.	37
Winnemucca, Nev	16	19	13	30	s. 80 w.	17
Salt Lake City, Utah	16	22	19	20	s. 9 w.	6
Northern Plateau.						
Baker City, Oreg	21	32	8	8	s.	11
Idaho Falls, Idaho	19	24	7	16	s. 61 w.	10
Spokane, Wash	14	22	20	19	s. 7 e.	8
Walla Walla, Wash	8	32	11	20	s. 21 w.	26
North Pacific Coast Region.						
Fort Canby, Wash	40	6	3	22	n. 29 w.	39
Port Angeles, Wash.*	17	0	4	20	n. 43 w.	23
Seattle, Wash	22	18	10	24	n. 74 w.	15
Tacoma, Wash	30	10	2	26	n. 50 w.	31
Portland, Oreg	36	13	7	23	n. 35 w.	28
Roseburg, Oreg	42	2	20	15	n. 7 e.	40
Middle Pacific Coast Region.						
Eureka, Cal	28	11	3	38	n. 64 w.	39
Red Bluff, Cal	20	29	21	5	s. 61 e.	18
Sacramento, Cal	6	43	5	21	s. 23 w.	40
San Francisco, Cal	2	28	0	40	s. 57 w.	48
South Pacific Coast Region.						
Fresno, Cal	31	5	4	41	n. 55 w.	45
Los Angeles, Cal	2	19	3	46	s. 68 w.	46
San Diego, Cal	23	16	2	39	n. 81 w.	38
San Luis Obispo, Cal	25	20	3	22	n. 75 w.	20

*From observations at 8 p. m. only. †From observations at 8 a. m. only.

TABLE VIII.—*Thunderstorms and auroras, July, 1898.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	55	T.	4	3	6	2	6	5	6	7	4	5	1	1	3	3	5	3	2	6	2	3	3	3	3	3	2	6	5	2	5	8	5	122	31	T.
		A.																																0	0	A.
Arizona	56	T.	3	5	6	10	8	8	3	2	8	5	6	7	8	8	7	7	2				1	1	1	1	5	5	5	5	5	4	5	141	28	T.
		A.																																0	0	A.
Arkansas	59	T.		5	10	8	2	2	2	4	4							9	4	3	1	8	12	5	4	10	9	8	1		6	15	13	145	23	T.
		A.																																0	0	A.
California	180	T.			1	3		1		3		1		1									1								1			12	8	T.
		A.																																0	0	A.
Colorado	72	T.	8	5	3	8	14	14	20	18	7	12	20	20	17	7	7	7	6	1	6	9	2	2	12	12	15	7	1		5	8	4	277	30	T.
		A.																																0	0	A.
Connecticut	21	T.			1	16					8									1	14	4	10								2	11	9	76	10	T.
		A.																																0	0	A.
Delaware	5	T.				2															3	1	1					2	2			1	1	13	8	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.				1													1		1		1					1	1	1		1	1	9	9	T.
		A.																																0	0	A.
Florida	45	T.	4	6	10	10	9	10	10	11	10	9	8	8	9	9	12	4	4	3	6	6	14	7	11	7	9	11	9	9	7	9	7	258	31	T.
		A.																																0	0	A.
Georgia	55	T.	6	2	4	8	10	9	9	5	4	5		2	2	2	1	2	1	1		3	4	4	7	8	8	6	8	6	10	7	4	148	29	T.
		A.																																0	0	A.
Idaho	38	T.			1			1	2	3	5	4	6	4	8	1	2			1				3			1		1					43	15	T.
		A.		1							1					1																		3	3	A.
Illinois	86	T.		1	5	3			1	13					1	1	2	2	13	2	22	3	1			8	30	3	12	25	29	17	3	197	22	T.
		A.					1									1		1		1		1												5	5	A.
Indiana	57	T.		1	16	4				2						2	5	10	12	4	3					7	17		1	15	9	12	1	121	17	T.
		A.																																0	0	A.
Indian Territory	7	T.									1							1	1	3		1	1										2	10	7	A.
		A.																																0	0	A.
Iowa	120	T.	1	24	1	1	2	9	5	6			2							12	35	2			1	6	1	5	33	2	10	3	5	166	21	T.
		A.																																0	0	A.
Kansas	85	T.		8	2			8	9	13	1							3			16	5	1			6	7	3	3	8	13	14	8	128	18	T.
		A.																																0	0	A.
Kentucky	48	T.		1	4	10				1	1				1	2	4	9	9	7	2	8	2	1	5	3	12	3	1	10	6	13	14	129	24	T.
		A.																																0	0	A.
Louisiana	46	T.	3	6	6	7	7	5	9	5	7	1	1	1	1	1	2	6	5	5	8	2	1	9	9	7	5	6	2	4	6	7	5	149	31	T.
		A.																																0	0	A.
Maine	18	T.				1					1						1				4	3	9		1	2	1	3		1			1	28	12	T.
		A.																																0	0	A.
Maryland	40	T.			2	22				3	3							4	5	5	18	11	9	4	2		2	5	15	7	5	4	14	140	19	T.
		A.																																0	0	A.
Massachusetts	59	T.				20	1		1		6									3	21	1	23	1				2	1		3	20	23	126	14	T.
		A.																																0	0	A.
Michigan	104	T.	1	4	8			1	2	8					1	2		6	2	14	22	2		1		3	11	3	7	29	9	1	2	139	22	T.
		A.																			1		1	1	1									4	4	A.
Minnesota	67	T.	11	7	1		8	11	6				2		1				6	16	13		5	1	11	10		7	5		5		2	128	19	T.
		A.																			3	3	2	1										9	4	A.
Mississippi	43	T.	8	12	9	8	4	1	5	10	6				1	1	7	6	9	7	5	2	4	9	9	10	9	8	6	5	7	9	14	191	28	T.
		A.																											1					1	1	A.
Missouri	95	T.		5	15	2	1	16	19	7						2	1	4	10	3	21	16	10	7		9	17	2	20	29	43	28	11	298	24	T.
		A.																														1	1	1	1	A.
Montana	40	T.		1	1		1		7	1	1	1	2	1	3	1	4	9	3			1	3	4	3		4			2	1	1		55	22	T.
		A.																					1							1				2	2	A.
Nebraska	144	T.	4	5				7	5	3	3	1	1	1	1				1	1	20	3	1	1	2	5	1	2	9	6	10	3	1	97	25	T.
		A.																																0	0	A.
Nevada	50	T.				3		1	1	3	3	2	3	4	1						2			1						2	1		27	15	T.
		A.																																0	0	A.
New Hampshire	21	T.	1			1													1	1	9	5	12				1				3	1	35	10	T.
		A.									1							1																2	2	A.
New Jersey	51	T.	1	1		19	1				14			1	2			1		8	18	11	24	3			4	7	7	1	12	12	147	19	T.
		A.																																0	0	A.
New Mexico	34	T.	4	5	4	5	3	3	4	6	4	3	3	7	8	6	6	5	4	2	5	4	2	2	4	4	4	2	4	3	7	6	6	135	31	T.
		A.																																0	0	A.
New York	113	T.	1	1	10	11				4	4				1			1	4	19	33	13	15	5	16	14	22	5	2	16	3	10	4	214	23	T.
		A.													1					1	2		2									1	7	5	A.
North Carolina	57	T.				1	4	4	1	1	2	2				1	1	2	4	2	2	3	2	2	1	1	1	3	3	2	1	2	3	51	25	T.
		A.																																0	0	A.
North Dakota	52	T.	6	1	2	1	8	1	2	1	4	..	3	1	3	2	4	2	9	2	4	2	8	1	9	1		5	2	1	1	1		87	28	T.
		A.																			1		1							1	1	1	1	5	5	A.
Ohio	134	T.			25	14	1			2	7					4	22	16	44	25	25	27	2		7	14	31	9	4	34	23	14	10	360	23	T.
		A.				1				1	1	1						1			2		1	1									1	10	8	A.
Oklahoma	21	T.		1	2					4	1					1		2	2		2	3								2	1	2	1	24	13	T.
		A.									1																							1	1	A.
Oregon	72	T.				1		1		1	7	3	4	1	4		1	2					3	3		1								32	13	T.
		A.																																0	0	A.
Pennsylvania	105	T.	1	1	4	15	1			9	12					1		2	8	12	28	22	10	6	2	5	14	4	10	12	13	19	12	223	23	T.
		A.																																0	0	A.
Rhode Island	8	T.				3					2										1		4									3	13	5	A.
		A.																																0	0	A.
South Carolina	40	T.	2		1	5	9	9	9	5	6	5		2	3	1		3	3	1	2	3	4	5	7	4	5	7	7	6	5	3	4	126	28	T.
		A.																																0	0	A.
South Dakota	56	T.	8	3			6	7	7	5	4	6	7		2	2	1	1	2		3	3	8	6	10	4		11	4	6	8	4		128	25	T.
		A.																			1	1	1											3	3	A.
Tennessee	59	T.	1	4	9	12	4	4	3	8	9			1	3	8	7	4	9	8	3	15	5	5	11	14	11	8	6	3	17	16	8	216	29	T.
		A.																																0	0	A.
Texas	89	T.	8	10	10	6	3	4		3	8	5	2			2	4	8	5	3	5	1	2		7	9	17	8	1	1			2	134	25	T.
		A.																																0	0	A.
Utah	38	T.					3	4	1		5	8	8	2		2	1	2		2	1					3			1		1		44	15	T.
		A.																																0	0	A.
Vermont	14	T.				2				2	1				1					4	7	3	8		3		1		1					33	11	T.
		A.																																0	0	A.
Virginia	48	T.				15				1	5					1	1	3	16	2	12	4	8	10	2			6	9	5	7	4	6	117	19	T.
		A.																																0	0	A.
Washington	50	T.				1					3	1	3	4	2			3						2	1	5	1							26	11	T.
		A.																																0	0	A.
West Virginia	33	T.			3	8										1	1	1	8	4	4	1	1	4			5	3	2	2	7	2	6	63	18	T.
		A.																																0	0	A.
Wisconsin	60	T.	7	9				1	8	2								1		10	26	3			1	1	1		17			2	5	94	15	T.
		A.																			1		1	1										3	3	A.
Wyoming	17	T.	2						3	1	3	2	2	5	1		6	3		2		1	2	1	1	1						2		38	17	T.
		A.																																0	0	A.
Sums	2,871	T.	95	137	182	269	116	147	160	183	184	81	84	74	88	74	116	154	217	202	436	218	238	119	163	198	280	178	227	267	293	300	238	5,713	....	T.
		A.	0	1	0	1	1	0	0	1	3	2	0	0	1	2	0	3	0	2	11	5	10	4	1	0	0	0	1	2	0	1	4	56	....	A.

TABLE IX.—*Average hourly sunshine (in percentages), July, 1898.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	Personal estimate.
																		H s.	*Hours.*		
Albany, N. Y	T.	51	44	51	62	71	82	88	98	93	95	95	91	83	68	51	46	347.1	465.2	75	49
Atlanta, Ga	T.	42	33	32	35	42	52	57	66	67	58	55	46	42	41	32	39	306.7	439.7	47	30
Atlantic City, N. J	P.	50	40	40	46	52	58	61	58	71	73	77	67	63	50	41	39	254.9	453.0	56	51
Baltimore, Md	T.	27	23	30	48	68	83	85	81	85	81	72	66	65	47	25	26	271.4	453.0	60	56
Binghamton, N. Y	T.	32	30	35	43	55	69	69	74	71	71	64	55	42	29	23	25	233.7	461.8	51	38
Bismarck, N. Dak	P.	74	75	75	75	75	76	75	74	74	74	74	75	76	71	77	74	357.0	479.6	74	60
Boston, Mass	T.	36	45	50	56	53	55	56	67	67	71	64	52	51	51	42	37	252.1	461.8	55	43
Buffalo, N. Y	T.	55	51	76	89	94	95	91	88	94	97	90	89	87	73	53	39	376.2	465.2	81	45
Charleston, S. C	T.	43	20	26	41	42	45	48	50	55	41	43	40	40	25	19	23	166.8	437.2	38	37
Chattanooga, Tenn	T.	43	35	36	45	53	57	62	68	69	70	63	57	42	25	24	28	221.6	442.0	50	47
Cheyenne, Wyo	P.	69	67	77	81	83	88	87	81	75	66	66	68	67	73	56	43	333.8	458.6	73	60
Chicago, Ill	T.	45	41	49	74	84	85	87	89	86	90	89	86	88	72	63	69	352.7	461.8	76	77
Cincinnati, Ohio	T.	70	68	68	74	83	84	92	93	93	96	90	83	74	69	55	61	360.0	453.0	79	58
Cleveland, Ohio	T.	70	65	64	64	78	76	79	85	84	84	85	79	78	65	57	60	341.2	461.8	74	73
Columbia, Mo	T.	61	57	55	63	74	74	82	85	84	87	84	82	76	75	74	68	338.8	453.0	75	53
Columbus, Ohio	T.	71	74	91	95	100	99	99	99	98	91	95	94	97	94	67	65	415.1	455.2	91	57
Denver, Colo	P.	68	66	71	84	87	89	89	82	69	77	66	55	57	61	63	77	331.2	455.2	73	56
Des Moines, Iowa	T.	81	81	78	81	88	90	95	92	89	85	80	68	62	65	62	69	366.8	461.8	79	74
Detroit, Mich	T.	61	58	62	79	83	83	83	89	89	85	86	82	74	66	63	63	353.3	461.8	77	62
Dodge, Kans	P.	40	55	72	71	76	80	86	83	77	80	79	79	79	75	44	32	326.7	450.1	73	62
Dubuque, Iowa	T.	66	61	76	82	95	98	96	92	91	91	93	89	85	73	64	67	386.6	461.8	84	73
Eastport, Me	P.	36	34	41	45	49	53	58	58	61	66	69	72	63	54	42	33	249.6	471.7	53	36
Erie, Pa	T.	70	68	71	78	79	81	86	88	87	88	79	78	67	58	49	50	343.4	461.8	74	55
Eureka, Cal	P.	4	8	9	13	19	30	44	55	59	55	56	54	51	56	46	45	179.7	458.6	39	40
Fresno, Cal	T.	74	74	74	78	91	95	99	99	100	97	99	97	92	85	84	84	402.8	447.4	90	90
Galveston, Tex	P.	.....	33	65	72	74	79	79	81	73	69	70	70	71	54	15	8	278.7	427.4	65	51
Helena, Mont	P.	76	80	82	82	89	85	87	80	74	77	77	67	73	73	63	51	365.8	479.6	76	70
Huron, S. Dak	T.	58	55	55	61	69	69	70	75	75	71	68	52	44	41	51	48	283.0	468.4	60	55
Idaho Falls, Idaho *	T.	55	62	71	86	91	92	91	93	96	88	81	81	73	73	62	50	297.2	373.4	80	75
Indianapolis, Ind	T.	61	58	56	58	61	79	85	83	83	77	75	72	64	57	61	65	313.8	455.2	69	55
Jacksonville, Fla	T.	.....	30	38	52	75	81	84	86	83	73	65	51	39	27	22	27	249.0	429.6	58	45
Kansas City, Mo	P.	56	53	60	66	78	78	78	81	77	80	85	84	75	67	49	58	323.8	453.0	71	62
Key West, Fla	T.	.....	33	43	69	72	71	81	80	88	85	81	74	47	26	12	.....	263.5	419.1	63	62
Knoxville, Tenn	T.	48	29	32	45	63	68	74	76	75	75	70	65	47	40	30	36	249.3	444.3	56	46
Little Rock, Ark	T.	62	54	54	50	60	68	68	70	70	71	66	60	51	47	45	45	263.0	442.0	60	43
Los Angeles, Cal	P.	25	42	39	56	72	86	96	99	94	97	99	100	97	94	91	91	365.4	439.7	83	69
Louisville, Ky	T.	53	45	45	51	63	77	81	85	86	75	79	74	73	51	50	57	299.0	450.1	66	43
Minneapolis, Minn	T.	40	39	51	69	74	78	86	87	85	88	76	75	73	62	44	41	321.0	471.7	68	.....
Nashville, Tenn	T.	58	49	52	68	77	90	90	92	89	87	75	73	71	64	57	37	325.3	444.3	73	54
New Orleans, La	T.	.....	40	39	43	53	57	65	66	62	53	46	40	40	25	23	27	199.9	429.6	47	52
New York, N. Y	T.	36	24	39	45	55	57	66	66	70	75	76	64	58	48	19	21	242.9	458.6	53	45
Northfield, Vt	P.	38	42	57	69	76	79	79	77	75	75	69	63	64	58	41	41	300.5	468.4	64	50
Oklahoma, Okla	T.	62	71	74	87	94	99	98	100	97	97	89	85	88	83	79	75	389.9	442.0	88	81
Omaha, Nebr	T.	49	51	68	79	78	75	68	63	68	73	74	76	73	77	74	73	324.8	458.6	71	67
Parkersburg, W. Va	T.	47	39	38	49	67	75	76	76	67	75	69	62	58	43	26	30	261.4	453.0	58	51
Philadelphia, Pa	T.	52	42	42	46	55	70	77	89	93	95	90	77	67	50	37	38	297.9	455.2	65	40
Phenix, Ariz	P.	14	48	66	77	87	87	84	88	90	93	92	90	83	74	58	57	348.5	437.2	80	76
Pittsburg, Pa	T.	48	42	56	75	86	90	92	92	91	88	85	78	68	67	52	55	342.5	458.6	75	41
Portland, Me	T.	29	34	49	53	67	82	85	90	89	89	87	84	77	58	37	21	312.3	468.4	67	42
Portland, Oreg	T.	49	44	46	48	68	76	86	90	90	89	90	92	90	82	72	68	354.0	475.7	74	69
Raleigh, N. C	T.	42	33	30	37	47	57	73	79	74	73	66	60	43	27	25	28	227.4	444.3	51	39
Rochester, N. Y	T.	65	67	72	74	78	83	84	80	84	78	77	79	70	60	48	42	335.9	465.2	72	67
St. Louis, Mo	T.	51	44	48	62	75	83	83	81	81	83	80	76	69	70	55	50	316.8	453.0	70	51
St. Paul, Minn	P.	59	60	69	78	81	76	79	80	79	79	73	75	75	70	59	67	343.8	471.7	73	61
Salt Lake City, Utah	P.	55	64	75	81	85	89	86	91	88	86	91	90	89	86	81	71	382.3	458.6	83	65
San Diego, Cal	P.	29	17	18	30	53	66	77	91	93	93	93	90	83	80	71	68	299.6	437.2	69	80
San Francisco, Cal	T.	11	13	36	40	60	80	96	98	100	100	99	97	92	70	44	40	322.5	450.1	72	60
Santa Fe, N. Mex. †	P.	52	61	74	73	81	83	83	76	66	51	61	58	44	35	14	8	251.9	416.3	61	37
Savannah, Ga	P.	33	34	52	58	55	52	55	62	61	56	62	58	45	44	37	27	296.9	434.5	52	40
Seattle, Wash	T.	34	39	40	42	51	63	74	83	84	81	80	77	72	63	52	50	299.8	483.2	62	65
Spokane, Wash	T.	83	84	83	89	95	97	97	95	89	90	92	89	81	82	78	68	421.5	483.2	87	72
Tacoma, Wash	T.	43	44	45	58	70	75	82	84	88	87	85	85	80	76	67	57	341.7	479.6	71	69
Tampa, Fla	T.	.....	65	64	64	76	72	73	70	65	65	48	39	19	19	19	.....	230.8	424.9	54	50
Topeka, Kans	T.	63	55	57	57	70	72	75	85	80	73	69	58	63	50	48	53	293.2	453.0	65	.....
Vicksburg, Miss	T.	33	43	45	51	56	74	76	76	74	62	58	55	57	39	27	27	246.1	434.5	57	56
Washington, D. C	P.	41	43	43	54	64	61	63	71	71	71	65	65	59	47	48	52	264.7	453.0	58	53
Wilmington, N. C	T.	17	6	17	37	54	60	63	57	56	49	37	38	36	26	16	21	172.8	439.7	39	36
Yankton, S. Dak	T.	48	50	60	75	86	85	86	90	90	87	88	90	88	79	65	60	364.9	465.2	78	63

* All values for 25 days. † All values for 29 days.

TABLE X.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during July, 1898, at all stations furnished with self-registering gauges.*

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated.												
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	25-26			0.46														0.18			
Atlanta, Ga.	23	2.25 p. m.	7.00 p. m.	4.63	2.42 p. m.	4.42 p. m.	0.02	0.27	0.67	0.90	1.19	1.47	1.74	1.85	1.96	2.02	2.09				
								2.12	2.29	2.69	3.08	3.30	3.38	3.46	3.57	3.80	4.03	4.25	4.32		
Atlantic City, N. J.	12-13			1.18														0.46			
Baltimore, Md.	19	1.45 p. m.	4.25 p. m.	1.01	2.07 p. m.	2.35 p. m.	0.01	0.12	0.36	0.58	0.81	0.91	0.95								
Do	28	2.17 p. m.	3.15 p. m.	0.88	2.23 p. m.	2.43 p. m.	0.01	0.37	0.66	0.79	0.86										
Binghamton, N. Y.	25			0.95												0.46					
Bismarck, N. Dak.	21			0.23														0.20			
Boston, Mass.	4	4.00 p. m.	5.03 p. m.	0.48	4.37 p. m.	4.51 p. m.	0.06	0.04	0.24	0.40	0.42										
Buffalo, N. Y.*																					
Cairo, Ill.	29	12.02 a. m.	D. N.	2.44	12.05 a. m.	2.00 a. m.	T.	0.03	0.24	0.44	0.61	0.78	0.89	1.01	1.11	1.16	1.26	1.36	1.92	2.36	2.43
Charleston, S. C.	10-11	8.48 p. m.	5.19 a. m.	2.16	10.43 p. m.	11.29 p. m.	0.08	0.22	0.33	0.44	0.65	0.89	1.12	1.30	1.39	1.43					
Do	13	1.10 a. m.	2.25 p. m.	3.07	1.20 a. m.	1.45 a. m.	0.03	0.09	0.30	0.72	1.05	1.10									
					9.05 a. m.	9.30 a. m.	.....	0.21	0.55	0.65	0.79	0.89									
Do	23	10.50 a. m.	12.18 p. m.	1.60	11.00 a. m.	12.00 m.	0.01	0.27	0.37	0.39	0.43	0.53	0.56	0.65	0.86	1.13	1.39	1.59			
Chicago, Ill.*																					
Cincinnati, Ohio	31	5.25 p. m.	6.10 p. m.	0.68	5.36 p. m.	5.46 p. m.	0.02	0.30	0.58	0.60											
Cleveland, Ohio	18			0.46														0.46			
Columbia, Mo.	19-20	10.07 p. m.	3.30 a. m.	2.21	10.08 p. m.	11.54 p. m.	T.	0.09	0.26	0.46	0.53	0.67	0.77	0.83	0.87	0.92	1.01	1.14	1.53	1.80	1.85
Columbus, Ohio	20	1.00 p. m.	8.50 p. m.	1.36	1.04 p. m.	1.35 p. m.	0.01	0.27	0.54	0.73	0.89	0.97	1.03								
Denver, Colo.	25			0.21									0.21								
Des Moines, Iowa	2			0.34														0.28			
Detroit, Mich.	28			0.58														0.56			
Dodge, Kans.	7-8	9.38 p. m.	8.20 a. m.	0.92	9.58 p. m.	10.25 p. m.	0.05	0.10	0.15	0.27	0.50	0.62	0.66								
Duluth, Minn*																					
Eastport, Me.	15			0.25														0.10			
Erie, Pa.	25	12.10 p. m.	2.15 p. m.	0.80	12.10 p. m.	12.25 p. m.	0.00	0.21	0.48	0.58											
Fresno, Cal.†																					
Galveston, Tex.	16	7.50 a. m.	9.46 a. m.	1.18	8.10 a. m.	8.40 a. m.	0.06	0.14	0.40	0.64	0.82	1.03	1.10								
Hannibal, Mo.	7	D. N.	12.20 p. m.	1.86	7.45 a. m.	8.12 a. m.	0.21	0.12	0.27	0.44	0.70	1.05	1.14	1.16	1.18	1.21	1.25	1.36			
Harrisburg, Pa.	28	D. N.	5.30 a. m.	1.43	4.10 a. m.	4.48 a. m.	0.13	0.11	0.32	0.51	0.74	0.84	0.94	1.05	1.09						
Hatteras, N. C.	19-20	11.20 p. m.	4.10 a. m.	0.85	11.20 p. m.	12.10 a. m.	0.00	0.10	0.18	0.30	0.38	0.48	0.52	0.60	0.65	0.70	0.79	0.85			
Huron, S. Dak.	6	7.15 p. m.	8.50 p. m.	0.82	7.20 p. m.	7.55 p. m.	0.02	0.08	0.27	0.45	0.54	0.64	0.73	0.78							
Idaho Falls, Idaho	11-12			0.71														0.15			
Indianapolis, Ind.	25	12.20 p. m.	3.50 p. m.	1.81	1.40 p. m.	2.05 p. m.	0.66	0.23	0.43	0.58	0.66	0.72									
Do.	28	12.45 p. m.	1.38 p. m.	0.91	12.55 p. m.	1.20 p. m.	0.01	0.14	0.29	0.46	0.72	0.87									
Jacksonville, Fla.	8	3.30 p. m.	7.30 p. m.	1.76	4.49 p. m.	5.15 p. m.	0.35	0.40	0.80	1.02	1.15	1.24									
Do.	23	9.15 p. m.	11.30 p. m.	1.10	9.38 p. m.	10.20 p. m.	0.05	0.10	0.22	0.32	0.55	0.74	0.90	0.97	1.02						
Do.	28	6.05 p. m.	7.00 p. m.	0.98	6.12 p. m.	6.35 p. m.	0.05	0.10	0.35	0.72	0.82	0.87									
Jupiter, Fla.	2	2.40 p. m.	4.00 p. m.	1.18	3.23 p. m.	3.53 p. m.	0.20	0.15	0.40	0.60	0.77	0.87	0.93								
Do	14-15	11.00 p. m.	7.40 a. m.	1.62	2.55 a. m.	3.15 a. m.	0.32	0.05	0.25	0.45	0.65	0.72									
Kansas City, Mo.	21	8.25 p. m.	10.15 p. m.	1.53	8.45 p. m.	9.35 p. m.	0.22	0.08	0.25	0.40	0.55	0.62	0.80	0.95	1.05	1.11	1.16	1.21			
Key West, Fla.	13			0.43											0.35						
Knoxville, Tenn.	27			0.20												0.18					
Lincoln, Nebr.	6	6.15 p. m.	11.20 p. m.	3.52	7.47 p. m.	8.30 p. m.	0.04	0.18	0.43	0.51	0.56	0.63	0.71	0.87	0.94						
Little Rock, Ark.	31			0.70														0.55			
Los Angeles, Cal.	4			0.07								0.07									
Louisville, Ky.	25			0.69														0.49			
Memphis, Tenn.	26	2.50 a. m.	9.45 a. m.	1.49	5.00 a. m.	5.30 a. m.	0.42	0.08	0.21	0.33	0.54	0.74	0.83								
Milwaukee, Wis.	19	3.20 p. m.	4.25 p. m.	0.83	3.35 p. m.	4.10 p. m.	0.04	0.13	0.41	0.57	0.66	0.71	0.76	0.81							
Montgomery, Ala.	9	8.35 p. m.	11.45 p. m.	1.56	8.45 p. m.	9.25 p. m.	0.02	0.08	0.25	0.30	0.47	0.60	0.68	0.80	0.90	0.93	0.94	0.95	1.24	1.33	1.41
Nantucket, Mass.	9			1.16														0.48			
Nashville, Tenn.	25			0.83														0.66			
New Orleans, La.	7	8.50 a. m.	11.10 a. m.	1.25	9.17 a. m.	9.52 a. m.	0.01	0.13	0.33	0.58	0.83	0.95	1.08	1.14							
New York, N. Y.	30	2.50 p. m.	4.50 p. m.	1.44	3.13 p. m.	4.13 p. m.	T.	0.06	0.19	0.25	0.31	0.32	0.46	0.52	0.80	0.92	1.19	1.27			
Norfolk, Va.	19	7.10 p. m.	9.05 p. m.	2.25	7.15 p. m.	8.30 p. m.	T.	0.12	0.37	0.70	1.04	1.33	1.56	1.73	1.83	1.90	1.92	2.02	2.24		
Do.	31	6.45 p. m.	7.43 p. m.	1.52	6.50 p. m.	7.25 p. m.	0.01	0.18	0.41	0.73	1.00	1.18	1.35	1.43							
Northfield, Vt.	23			0.70														0.68			
Oklahoma, Okla.	8			0.55										0.55							
Omaha, Nebr.	6	1.02 p. m.	6.24 p. m.	2.98	4.49 p. m.	6.00 p. m.	0.33	0.67	0.97	1.27	1.47	1.63	1.71	1.91	2.05	2.21	2.33	2.53	2.61		
Parkersburg, W. Va.	19	12.38 p. m.	1.21 p. m.	0.97	12.52 p. m.	1.18 p. m.	0.05	0.25	0.56	0.70	0.82	0.92									
Do	31	2.30 p. m.	5.15 p. m.	1.35	2.58 p. m.	3.20 p. m.	0.27	0.28	0.54	0.80	0.91	0.96									
Philadelphia, Pa.	4	3.15 p. m.	7.00 p. m.	0.96	3.18 p. m.	3.48 p. m.	T.	0.15	0.33	0.45	0.57	0.75	0.80								
Pittsburg, Pa.	31	10.00 a. m.	10.50 a. m.	0.86	10.06 a. m.	10.25 a. m.	0.02	0.43	0.69	0.79	0.83										
Portland, Me.	19			0.33														0.32			
Portland, Oreg.	22			0.29														0.10			
Raleigh, N. C.	13	8.03 p. m.	10.00 p. m.	1.00	8.15 p. m.	8.45 p. m.	T.	0.18	0.38	0.48	0.63	0.74	0.78	0.82							
Do	27	4.53 p. m.	8.05 p. m.	0.87	4.57 p. m.	5.17 p. m.	T.	0.25	0.45	0.57	0.65										
Richmond, Va.	17-18	7.35 p. m.	D. N.	1.90	7.51 p. m.	8.30 p. m.	0.03	0.07	0.28	0.55	0.81	0.97	1.08	1.13	1.18						
Rochester, N. Y.	23	2.10 p. m.	5.45 p. m.	1.52	2.14 p. m.	2.37 p. m.	0.10	0.35	0.60	0.80	1.00	1.20	1.35	1.43	1.46	1.48	1.51	1.52			
St. Louis, Mo.	7	8.43 a. m.	3.20 p. m.	1.91	12.20 p. m.	1.01 p. m.	0.52	0.08	0.20	0.34	0.41	0.61	0.71	0.80	0.94						
Do.	8	12.20 a. m.	3.00 a. m.	3.17	1.14 a. m.	2.20 a. m.	0.10	0.09	0.26	0.41	0.56	0.82	1.11	1.24	1.31	1.79	2.34	2.82	2.95		
Do	30	1.05 a. m.	D. N.	0.81	1.07 a. m.	1.35 a. m.	T.	0.07	0.42	0.61	0.76	0.77									
St. Paul, Minn.	1			1.24														0.45			
Salt Lake City, Utah	11			0.07														0.05			
San Diego, Cal.†																					
San Francisco, Cal.†																					
Savannah, Ga.	5-6	9.00 p. m.	D. N.	0.76	10.40 p. m.	11.25 p. m.	0.04	0.10	0.32	0.49	0.58	0.61									
Do.	12-13	7.00 a. m.	D. N.	3.27	12.08 a. m.	12.30 a. m.	1.74	0.14	0.29	0.51	0.64	0.66	0.68	0.78							
Seattle, Wash.	16			0.12														0.02			
Spokane, Wash.	13			0.32														0.11			
Tampa, Fla.	25	5.10 p. m.	8.05 p. m.	2.00	5.10 p. m.	5.50 p. m.	0.00	0.35	0.60	0.75	1.00	1.15	1.30	1.50	1.70						
Vicksburg, Miss.	31	5.12 a. m.	6.15 a. m.	0.69	5.12 a. m.	5.32 a. m.	0.00	0.21	0.42	0.51	0.61										
Washington, D. C.	19	1.33 p. m.	3.35 p. m.	1.11	1.37 p. m.	2.22 p. m.	T.	0.06	0.18	0.40	0.65	0.89	0.90	0.94	0.99	1.04					
Wilmington, N. C.	8			0.79														0.55			
Yankton, S. Dak.	8	1.05 a. m.	3.15 a. m.	1.26	1.15 a. m.	1.45 a. m.	T.	0.10	0.30	0.72	0.93	1.05	1.11								
Do.	26-27	9.50 p. m.	1.25 a. m.	1.10	10.53 p. m.	11.33 p. m.	0.19	0.12	0.21	0.30	0.33	0.51	0.73	0.84							

*Record incomplete. †No precipitation during the month.

TABLE XI.—*Excessive precipitation, by stations, for July*, 1898.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Eufaula	11.27			1.24	1 10	23
Florence		2.95	29	2.95	2 00	25
Madison				2.08	1 00	4
Newburg				1.60	1 00	15
Do				1.44	1 00	30
Talladega				1.05	0 50	5
Thomasville				1.44	0 30	6
Arizona.						
Bisbee		3.94	1-2			
Fort Huachuca		4.05	4-5			
Arkansas.						
Conway				1.30	1 00	31
Dallas		3.80	25-26			
Elon				1.70	0 35	16
Do				1.40	0 40	27
Fayetteville		3.85	30-31			
Fulton				1.15	1 00	5
Jonesboro				1.23	1 00	21
Keesees Ferry				1.25	0 22	20
Lonoke				1.00	1 00	16
Marvell		3.05	7-8			
Monticello				1.20	1 00	3
Moore				1.35	1 00	17
Mount Nebo		3.04	3	3.04	3 00	3
Pond	13.97	7.42	20-21			
Russellville				1.31	0 25	2
Do				1.63	1 00	27
Silver Springs	11.60	5.68	20-21			
Do		5.61	30-31			
Wiggs		2.75	9	2.75	2 40	9
Connecticut.						
Colchester		3.25	12-13			
Hartford		3.08	13			
Middletown		3.56	13			
New London		2.95	12-13			
Lambert		4.32	13			
Voluntown		4.00	12-13			
Wallingford		3.25	13			
District of Columbia.						
Washington				1.09	1 00	19
Florida.						
Archer	18.18	5.30	11			
Bartow		2.56	29			
Brooksville	12.48	2.63	11	1.02	0 50	2
Clermont				2.20	2 00	4
Earnestville				1.10	1 00	13
Eustis	10.16	3.03	4			
Federal Point	13.01	3.09	11			
Gainesville	12.61	4.75	11-12			
Grasmere				1.52	1 10	23
Jacksonville	12.03	3.25	11-12	1.35	0 38	8
Do				1.10	0 45	23
Jupiter				1.15	1 00	2
Lake Butler	14.04	7.50	10-12	1.20	1 00	30
Lake City	11.96	7.39	11-12			
Lakemont	12.32					
Maclenny	15.79	4.76	11			
Manatee	13.93	3.43	10			
Merritts Island		3.12	8			
Myers		2.71	24	2.71	2 00	24
Ocala	12.66	2.80	30			
Orlando		3.08	21	2.21	0 46	21
St. Francis Barracks		4.65	11			
Stephensville	29.90	14.03	11-12			
Tallahassee	10.00	3.30	12			
Tampa		2.68	11	1.00	1 00	11
Do				1.80	0 45	25
Tarpon Springs	12.77	3.00	11			
Georgia.						
Alapaha	13.21					
Atlanta	10.22	5.56	22-23	4.30	1 51	23
Augusta		2.75	12-13			
Bainbridge				1.60	1 30	6
Brag	14.64	4.00	12			
Do		4.25	23			
Clayton	14.39	2.64	14			
Do		3.80	23			
Columbus				1.10	1 00	26
Covington	10.20	2.51	24			
Crescent	12.58	5.05	10-12			
Dahlonega	10.62					
Fleming	11.11	2.50	13			
Fort Gaines				1.89	1 00	13
Franklin	11.76					
Gainesville	12.12					
Gillsville		3.05	22			
Hephzibah	10.40					
Leverett	15.45	3.92	9			
Lumpkin	10.59	2.59	30	2.59	1 00	30
Marietta	13.19	3.40	19			
Mauzy	13.86	3.44	29-30	2.16	1 00	29
Millen	11.76					
Mount Vernon	10.00	2.50	12			
Point Peter	11.51	3.18	12-13			
Do		3.48	23	1.33	1 00	27
Quitman		2.53	11			
Ramsey				1.05	1 00	30
Savannah		3.18	12-13			
Talbotton	11.58					
Thomasville	10.38	2.56	12-13			

TABLE XI.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Georgia—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Toccoa		3.60	12-13			
Waycross	10.81	3.50	11-12			
Waynesboro	11.29					
Illinois.						
Cairo		2.74	29	2.13	1 26	29
Chester		3.40	7-8			
Cobden		3.19	28-29			
Friendgrove		3.20	25			
Hillsboro				1.19	1 13	25
Rantoul				1.00	0 40	17
Indiana.						
Angola				1.10	0 30	25
Bluffton				1.33	0 30	29
Connersville		3.35	25			
Delphi				1.28	0 50	25
Hector				2.00	0 30	17
Indianapolis		2.89	24-25	1.06	1 00	25
Knightstown		3.20	25	3.20	3 09	25
Richmond		2.88	25			
Shelbyville				2.33	2 00	25
Vevay				2.40	0 40	16
Worthington		2.86	3	2.86	1 15	3
Indian Territory.						
Kemp		3.00	16			
Lehigh		2.57	9	2.50	0 45	9
Purcell		3.15	9			
Tulsa		3.41	21			
Do		3.60	31			
Iowa.						
Audubon		3.70	27			
Clear Lake		3.15	6			
College Springs		4.65	6-7			
Council Bluffs		2.90	6			
Elkader		2.50	19			
Greene		2.70	19	2.20	1 00	19
Osceola				1.60	1 30	2
Sidney		6.00	6			
Do		2.56	27	2.56	0 25	27
Stuart		2.60	25	1.00	1 00	18
Thurman	12.88	9.70	6-7			
Winterset		2.70	9			
Kansas.						
Achilles		3.25	5			
Columbus		2.70	31			
Dresden		2.63	5	2.63	2 00	5
Eureka		2.90	19			
Grenola		3.78	31	3.71	4 00	31
Independence		3.78	31			
Norton		3.50	5-6			
Oberlin		3.30	6	3.30	2 00	6
Kentucky.						
Alpha		4.64	28			
Bardstown		2.90	5	1.17	1 00	26
Blandville		2.86	16			
Leitchfield				1.35	0 20	17
Paducah				1.46	1 20	26
Vanceburg	12.10	4.20	24-25			
Louisiana.						
Bastrop		3.59	24-25			
Baton Rouge	10.76	2.55	24	1.42	1 00	23
Cheneyville				1.35	1 05	27
Clinton	11.99	2.67	16			
Como				1.25	1 00	22
Donaldsonville		2.85	17			
Emilie				2.04	2 00	22
Grand Coteau		3.64	23-24			
Jennings		2.80	24			
Lake Charles				1.70	1 00	23
Mansfield				1.10	0 40	10
Do				2.25	2 00	18
Minden				1.63	1 00	27
New Orleans				1.21	1 00	7
Port Eads		2.70	9			
Rayne				1.07	0 30	3
Do				1.06	0 45	16
Southern University	10.05	2.80	17			
Maine.						
Farmington				1.00	1 00	21
North Bridgton		2.52	19			
Maryland.						
Cherryfields		2.65	31			
Collegepark				1.27	0 30	19
Denton		2.50	21			
Grantsville		4.00	17	4.00	2 00	17
Pocomoke City		2.54	6	1.03	1 00	21
Solomons				1.75	1 30	19
Massachusetts.						
Bluehill		3.14	13			
Chestnut Hill		2.55	13			
Cohasset		3.55	13-14			
Fallriver		4.33	12-13			
Hingham		3.64	13			
Hyannis		2.76	13			
Hydepark		2.89	13			
Long Plain		4.71	12-13			
Mansfield		3.89	13-14			
Middleboro		4.13	13			
Milton		2.96	13			
New Bedford		4.20	13-14			
Provincetown		3.90	13			

TABLE XI.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Massachusetts—Continued.	*Inches.*	*Inches.*		*Ins.*	*h. m.*	
Roxbury		2.64	13-14			
Somerset		3.94	13			
Taunton		5.08	12-13			
Vineyard Haven		2.96	12-13			
Weston				1.62	1 30	21
Woods Hole		3.41	12-13			
Michigan.						
Big Rapids				1.55	1 30	28
Flint				1.16	1 00	19
St. Ignace		2.90	7			
Minnesota.						
Beardsley		2.73	1			
Do		3.25	6			
Detroit City		2.60	2			
Fergus Falls		4.87	1-2			6
Milan				1.23	0 25	
Minneapolis		2.65	•			
Morris		2.90	1-2			
Newfolden		2.70	1			
New London		3.70	1			
Park Rapids		3.73	1-2			
Pokegama Falls		3.36	1-2			
Tower		3.50	1			
Willow River		2.78	18			
Mississippi.						
Austin		2.80	31			
French Camps		2.57	15	1.30	1 00	3
Lake	11.17			2.12	1 50	4
Leakesville		3.04	17			
Do		2.60	23			
Natchez				1.00	1 00	17
Pontotoc		3.42	15			
Walnut Grove	12.91	3.30	8			
Missouri.						
Appleton City		2.75	30			
Bethany		2.65	6-7			
Birchtree		2.92	31			
Bolckow		2.50	6			
Columbia				1.14	1 00	19
Conception	10.27	7.23	6-7			
Edgehill	15.06	8.00	8			
Do		3.88	29			
Fairport		2.50	7			
Fulton		3.30	30			
Gallatin		3.10	6-7			
Gorin		4.00	7			
Halfway		3.92	29-30			
Hannibal				1.50	1 30	7
Ironton		4.30	7-8			
Do		3.02	29			
Kansas City				1.21	1 00	21
Lamar				2.05	0 30	6
McCune		4.45	7	4.00	4 00	7
Maryville		6.84	6-7			
Mineral Spring	12.07	2.62	21-22			
Do		3.30	30-31			
Neosho		5.40	30-31	2.50	2 00	30
Oakfield		2.70	7			
Osceola		3.58	30-31			
Pickering	10.28	8.15	6-7			
Potosi		2.83	29			
St. Louis		5.08	7-8	1.03	1 00	7
Do				2.86	1 02	8
Springfield		2.62	30			
Steffenville		4.25	7			
Stellada		2.80	29-30			
Wheatland		2.54	29	2.54	2 00	29
Willow Springs				1.60	1 00	3
Do				1.60	1 00	21
Nebraska.						
Bassett		2.65	1			
Lincoln		3.52	6			
Norman				1.34	1 00	24
Omaha		3.55	6	2.98	1 53	6
Plattsmouth	11.53	10.69	6-7			
Ravenna				1.10	0 38	24
Santee Agency		2.62	7-8			
Seneca		2.50	9			
State Farm		6.12	7			
Thedford				1.70	1 30	1
Turlington				1.20	0 50	27
New Hampshire.						
Plymouth				1.80	1 00	21
New Jersey.						
Asbury Park	11.72	3.58	14			
Do		3.86	27			
Belvidere		2.78	19			
Charlotteburg				1.71	1 00	20
Egg Harbor City				1.13	0 30	31
Freehold		3.03	27			
Gillette		2.70	19			
Imlaystown				1.84	1 00	21
Ocean City		2.95	12-13	1.20	1 00	9
Staffordsville		5.27	12-13	1.80	1 00	30
Toms River		3.35	12-13			
Do		3.85	27			
New Mexico.						
Clayton				1.55	0 25	7
Lower Penasco		2.50	4			
Raton				1.00	0 30	4
				2.00	1 00	8

TABLE XI.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
New York.	*Inches.*	*Inches.*		*Ins.*	*h. m.*	
Gloversville		3.38	18-19			
Lake Placid		2.50	18			
Liberty				1.75	1 30	21
New Lisbon		4.02	19			
New York				1.27	1 00	30
Ogdensburg				1.55	1 00	27
Perry City				1.05	0 50	28
Rochester				1.40	0 34	23
Romulus				1.76	1 10	25
St. Johnsville		3.25	18			
Setauket		4.20	13			
North Carolina.						
Flat Rock	13.73	3.90	14			
Hendersonville	11.21			1.05	0 30	31
Horse Cove	17.14	6.22	13-14			
Do		2.95	22			
Louisburg		4.38	5-6			
Lumberton		2.95	31			
Marion	10.07					
Mountairy		2.59	27	1.90	1 30	27
Mount Pleasant		4.76	6-7			
Pittsboro		2.61	5			
Raleigh		2.53	5-6			
Rockingham		2.90	5			
Selma		2.75	5			
Southern Pines	12.46	6.98	6-7			
Southport	13.76	4.20	10			
Weldon		2.86	5-6			
North Dakota.						
University		2.50	1	2.50	1 00	1
Wahpeton		4.53	1			
Ohio.						
Bigprairie		3.05	14-15			
Circleville		3.70	25			
Columbus				1.19	1 00	30
Dayton				1.12	0 50	15
Hillsboro		4.00	25	3.00	1 30	25
Killbuck				1.35	1 00	15
Leipsic		5.55	30	1.55	1 00	27
Logan		2.67	31	2.67	1 10	31
McArthur				1.23	1 00	27
Milligan				1.00	1 00	28
Montpelier				2.15	2 05	28
New Holland		3.79	25			
New Moscow		2.54	15			
Portsmouth				1.55	0 30	18
Ripley		3.36	18	3.36	1 45	18
Seaman				1.01	0 30	15
Do				1.00	0 30	30
Vanceburg	10.65			2.00	2 00	15
Do				1.12	1 00	17
Do		3.55	25	3.55	3 00	25
Vickery		2.50	17			
Wellington		3.91	17	1.18	1 00	28
Wooster				1.72	1 00	17
Youngstown				2.26	2 00	24
Oklahoma.						
Arapaho		3.75	19	3.75	3 00	19
Do		2.71	21			
Hennessey		3.30	30			
Kingfisher		5.47	20-21			
Pawhuska		4.01	30	4.01	3 40	30
Stillwater		3.67	20-21			
Waukomis		3.08	19			
Pennsylvania.						
Hamburg		3.86	28			
Harrisburg				1.24	1 00	28
Johnstown				1.08	0 35	17
Oil City				1.56	1 00	24
Selinsgrove		2.55	27			
Shawmont		2.87	27			
Sinnamahoning		2.73	25			
Swarthmore		3.45	26-27			
Towanda				1.53	0 30	22
Uniontown				1.38	0 45	17
Rhode Island.						
Block Island		6.22	12-13	2.30	2 00	13
Bristol		4.27	13			
Kingston		5.50	12-13			
Lonsdale		3.97	13	1.61	1 10	21
Pawtucket		4.16	12-13			
Providence	10.80	4.77	13			
Do		3.32	31	2.30	1 00	31
South Carolina.						
Allendale		3.20	23	3.20	1 10	23
Camden	11.62	4.23	5-6			
Charleston	12.99	3.38	10-11	1.51	1 00	10
Do		3.38	12-13	1.16	1 00	13
Do				1.05	1 00	13
Do				1.57	1 00	23
Cheraw		3.00	5-6			
Columbia	12.17	4.16	5-6			
Greenville	11.20	4.89	6			
Longshore				2.00	1 30	9
Santuck				1.50	0 15	27
Society Hill		4.46	5			
Trenton	11.37	3.07	5-6			
Walhalla				1.60	1 00	7
Do				1.00	0 30	27
South Dakota.						
Gannvalley				2.00	1 00	22

TABLE XII.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
South Dakota—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Hotch City				1.59	0 30	7
Pierre				1.54	0 47	7
Yankton				1.10	0 31	8
Tennessee						
Clarksville		2.50	25-26			
Dover		3.92	25-26			
Elk Valley		3.29	29-30			
Grace		2.60	3-4	1.90	1 00	4
Kingston				1.00	1 00	8
Lewisburg		2.60	26-27	1.00	1 00	3
Liberty		2.93	26-27			
Lynnville				1.30	1 00	30
Madison		3.06	25-26			
Milan				1.30	1 00	5
Do		3.25	31	3.25	3 00	31
Newport				1.35	1 00	9
Palmetto		2.68	25-26			
Pope				1.10	1 00	15
Sewanee		4.00	26-27			
Springfield		4.70	25-26			
Sylvia		2.82	9			
Tracy City		3.32	26-27			
Tullahoma		3.25	26-27			
Wildersville		2.50	30-31			
Texas.						
Arthur City				1.60	1 22	17
Breckenridge		3.58	17			
Cuero				1.20	1 30	5
Gainesville				1.10	0 45	5
Galveston				1.09	0 27	16
Hulen				1.33	1 00	16
Langtry				1.35	1 10	26

TABLE XIII.—*Excessive precipitation.*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Texas—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Luling				1.43	1 15	10
Mann		3.35	9-10			
Rheinland		4.13	9	3.13	2 30	9
Tulia		3.22	2			
Vermont.						
St. Johnsbury		5.18	18-19			
Virginia.						
Bigstone Gap				1.07	0 45	15
Do				1.15	0 30	16
Birdsnest				1.00	0 50	19
Blacksburg				1.07	0 30	17
Doswell				1.55	1 10	19
Hampton		2.55	5-6			
Lynchburg		2.56	17			
Norfolk				1.89	0 45	19
Do				1.43	0 36	31
Richmond				1.18	0 39	17
West Virginia.						
Martinsburg				1.20	0 30	4
New Cumberland		2.65	27	2.65	1 30	27
Nuttallburg				1.00	1 00	28
Parkersburg				1.28	1 00	31
Powellton				1.70	1 40	25
Wisconsin.						
Beloit		3.90	19-20	1.00	1 00	19
Harvey		3.54	18-19			
Madison		2.60	19-20			
North Crandon				1.80	1 00	19

* June 30—July 1.

Chart I. Tracks of Centers of High Areas. July, 1898.

Chart I. Tracks of Centers of High Areas. July, 1898.

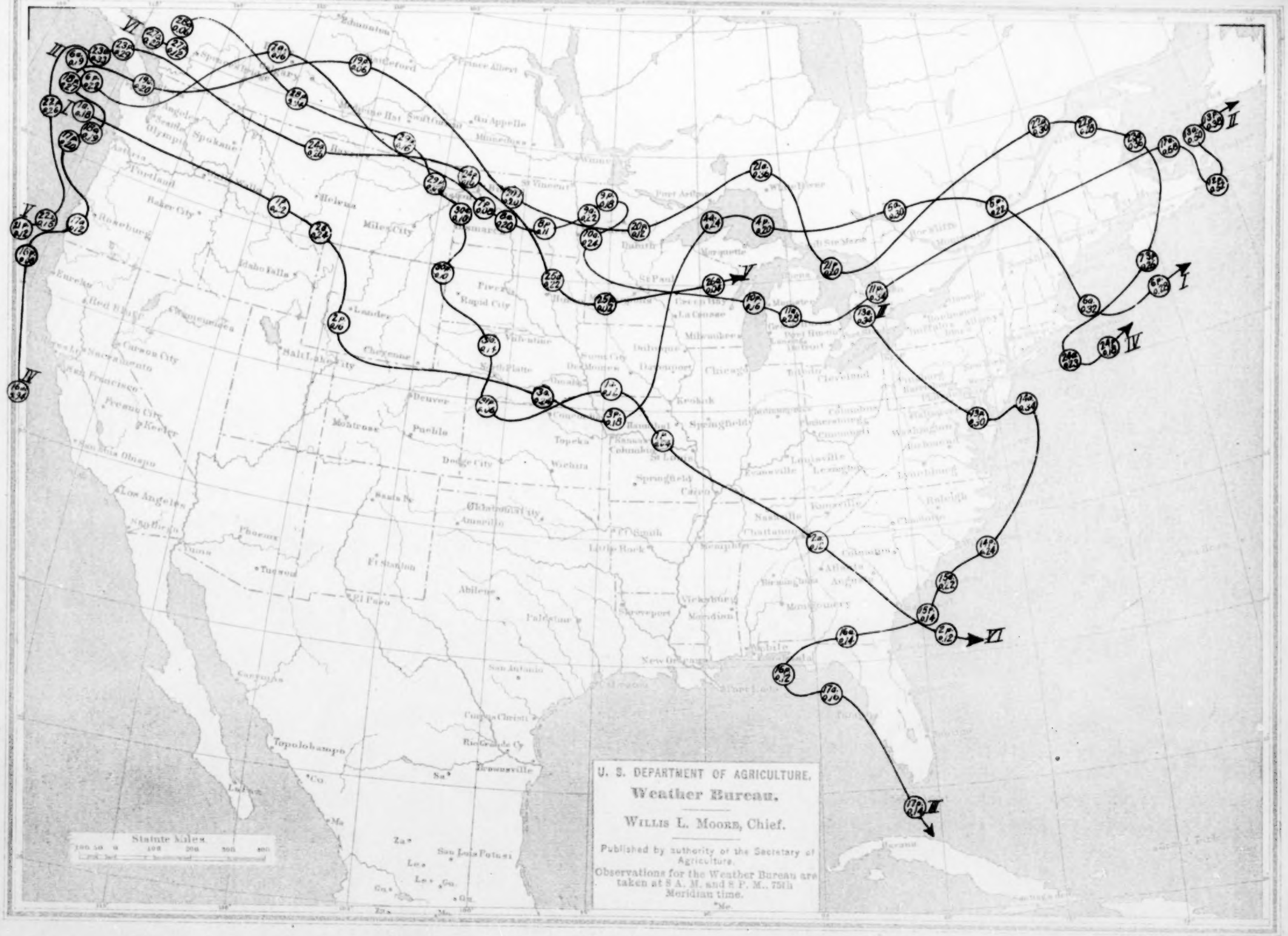


Chart II. Tracks of Centers of Low Areas. July, 1898.

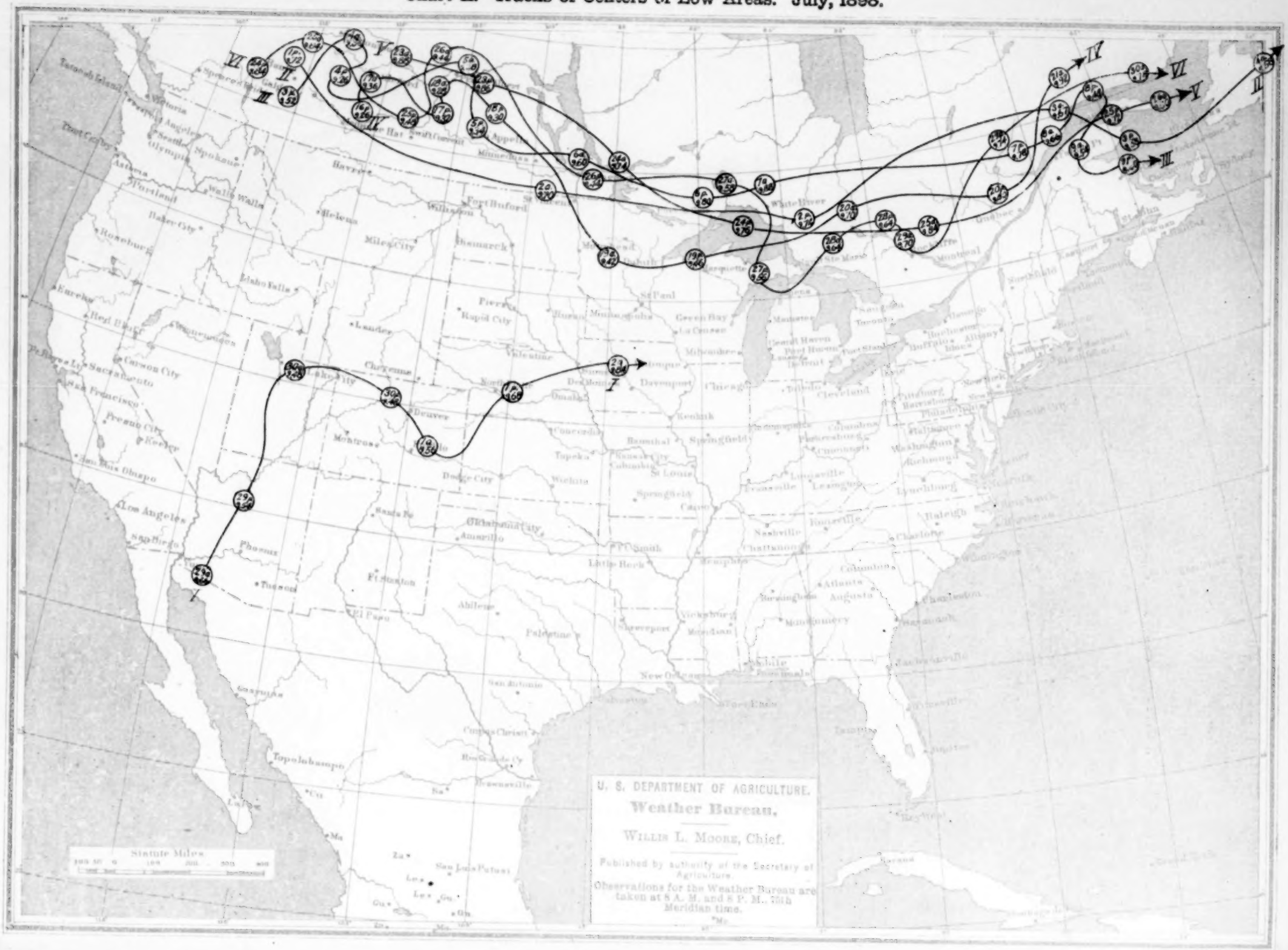


Chart III. Total Precipitation. July, 1898.

Chart III. Total Precipitation. July, 1898.

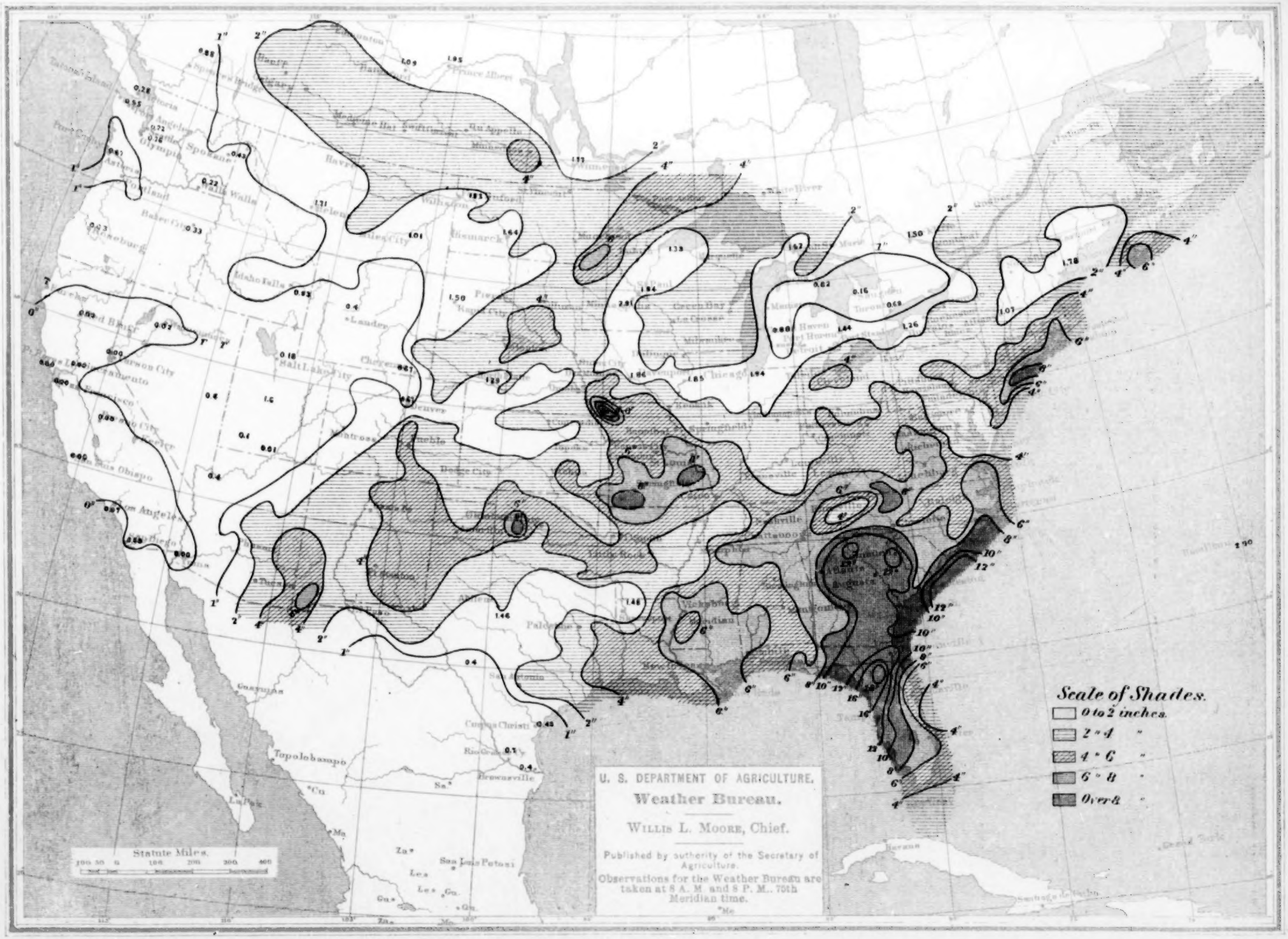
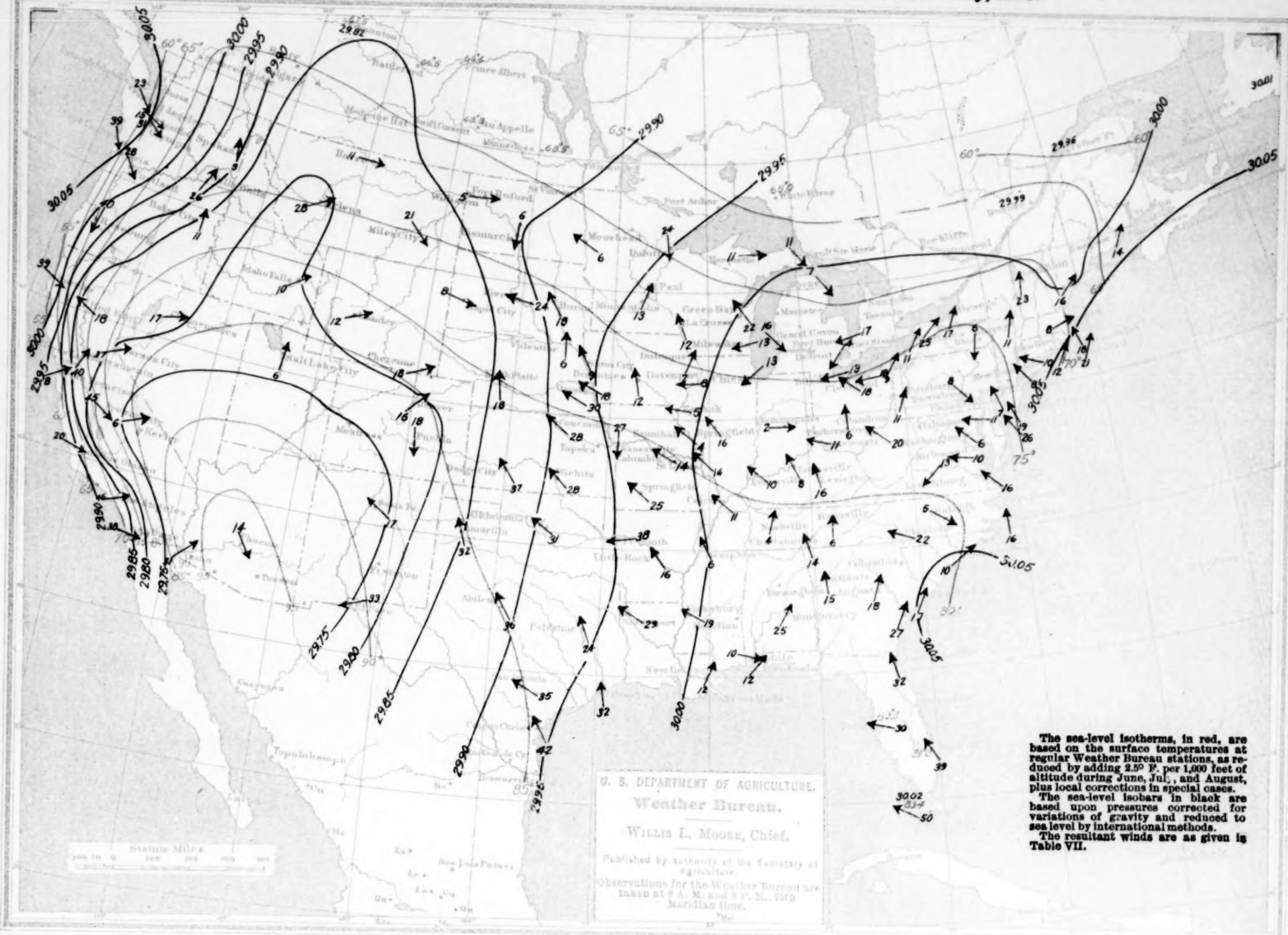

Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
Statute Miles.
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
Willis L. Moore, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart IV. Sea-Level Pressure and Temperature and Resultant Surface Winds. July, 1898.


U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles

The sea-level isotherms, in red, are based on the surface temperatures at regular Weather Bureau stations, as reduced by adding 2.5° F. per 1,000 feet of altitude during June, July, and August, plus local corrections in special cases.

The sea-level isobars in black are based upon pressures corrected for variations of gravity and reduced to sea level by international methods.

The resultant winds are as given in Table VII.

Chart V. Hydrographs for Seven Principal Rivers of the United States. July, 1898.

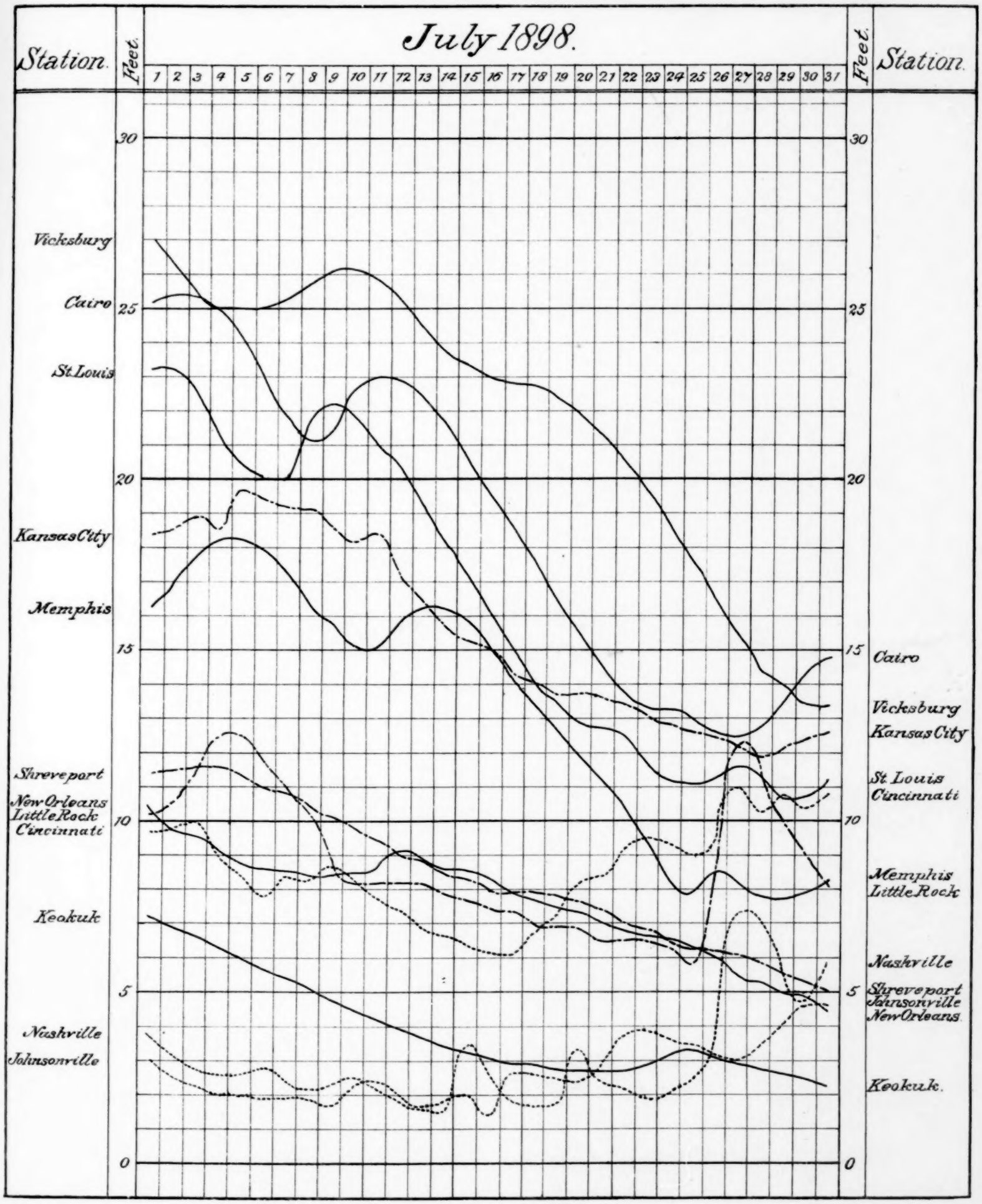


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. July, 1898.

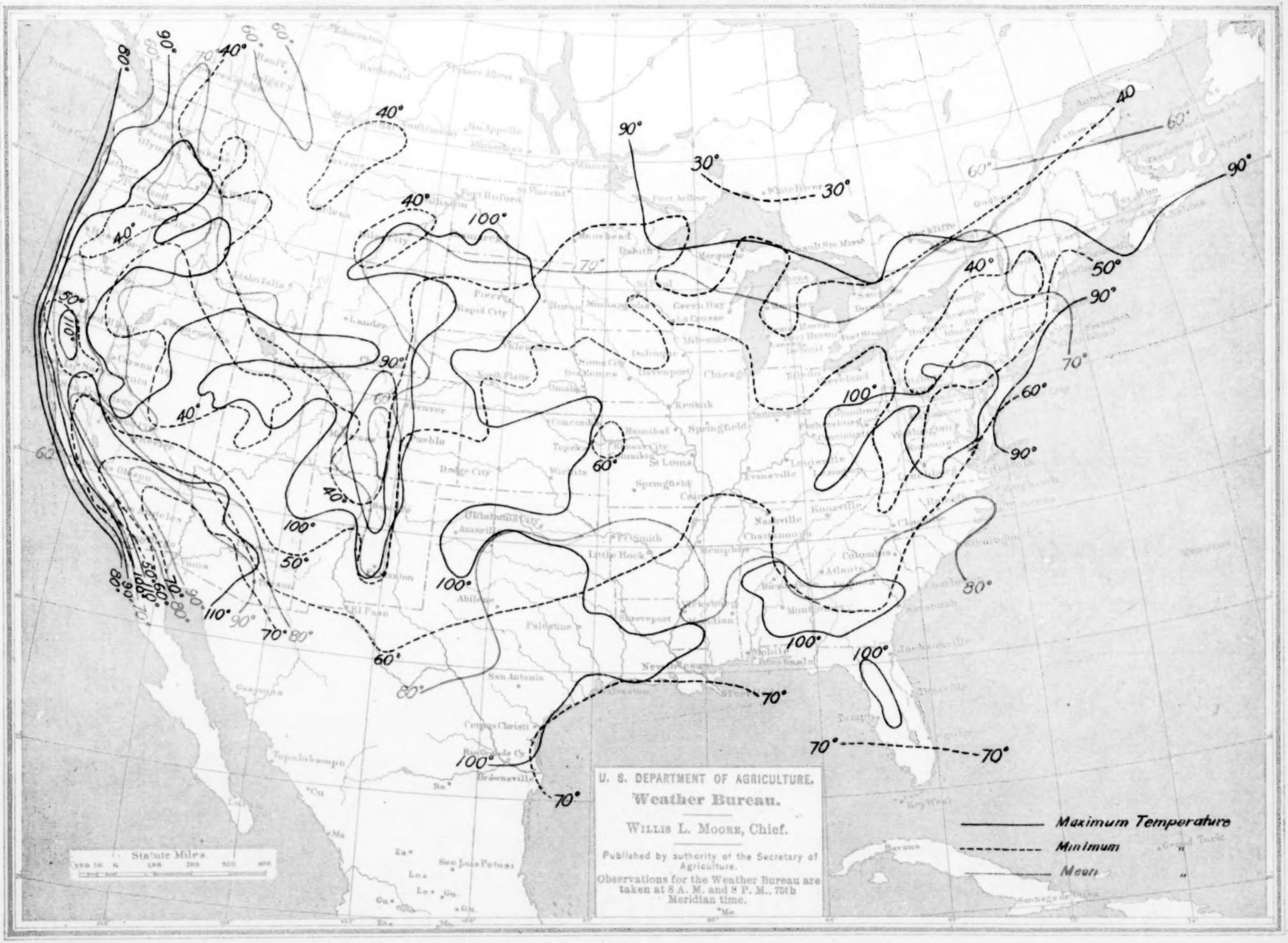

U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Maximum Temperature
Minimum "
Mean "
Statute Miles

Chart VII. Percentage of Sunshine. July, 1898.

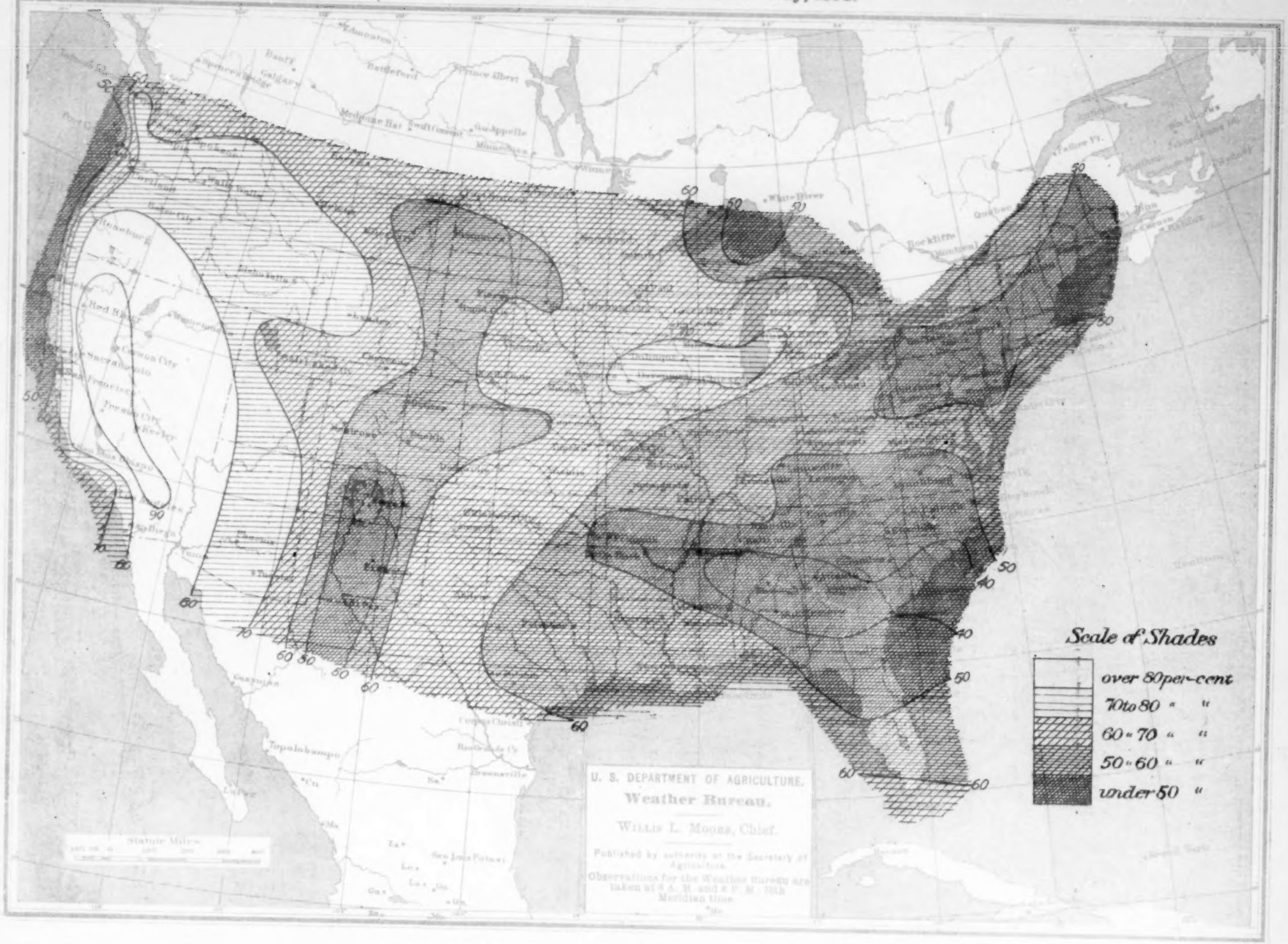
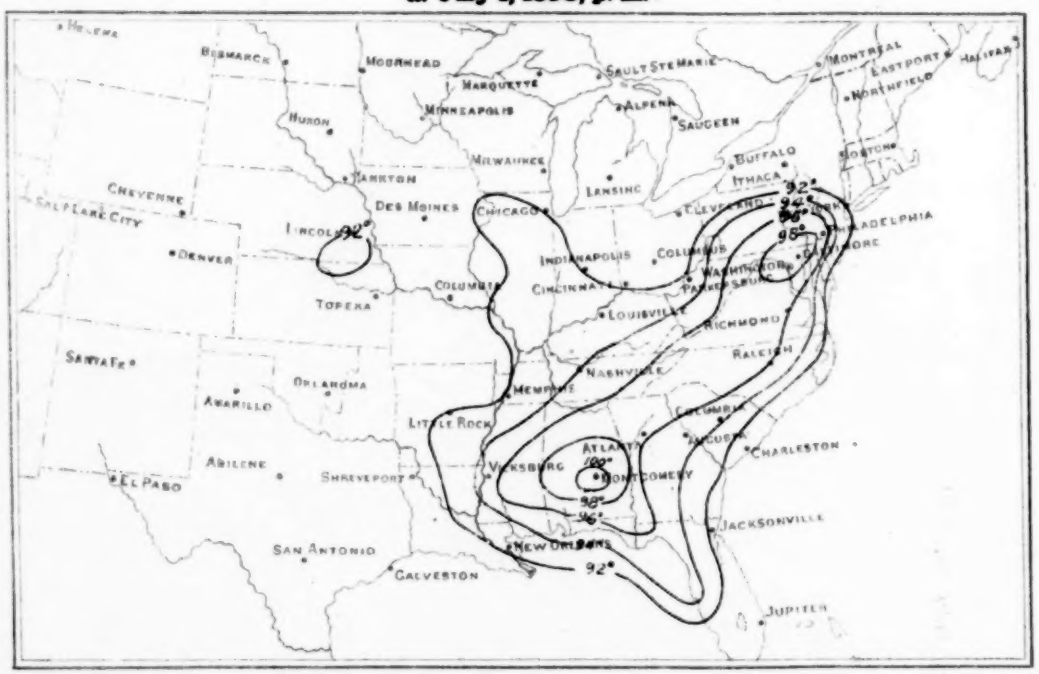
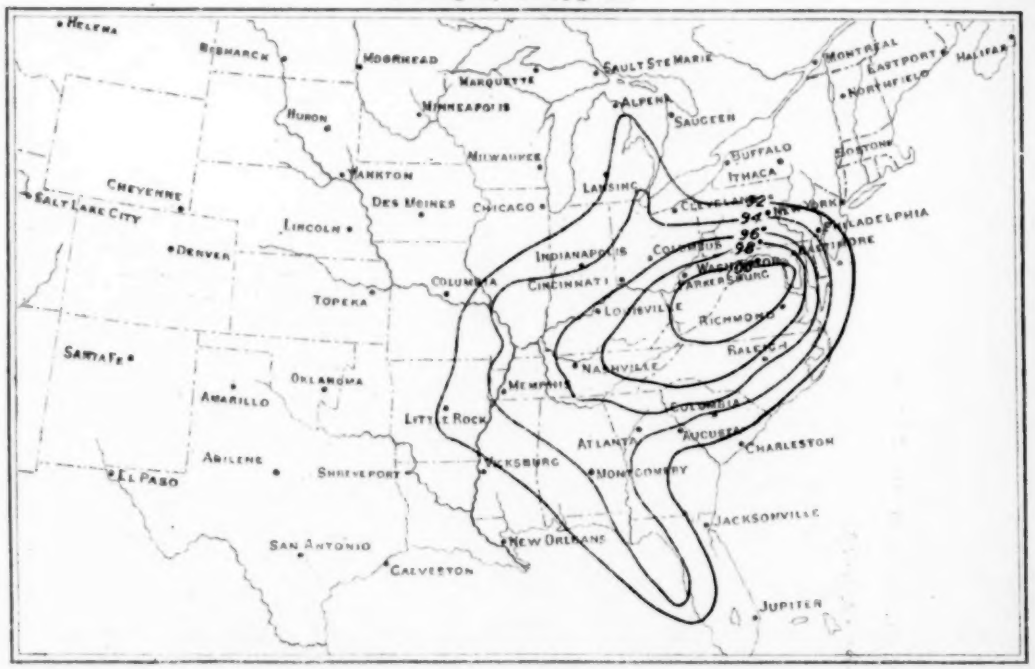

Scale of Shades
over 80 per cent
70 to 80 " "
60 " 70 " "
50 " 60 " "
under 50 "
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
Willis L. Moore, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles

Chart VIII. Maximum Temperatures.

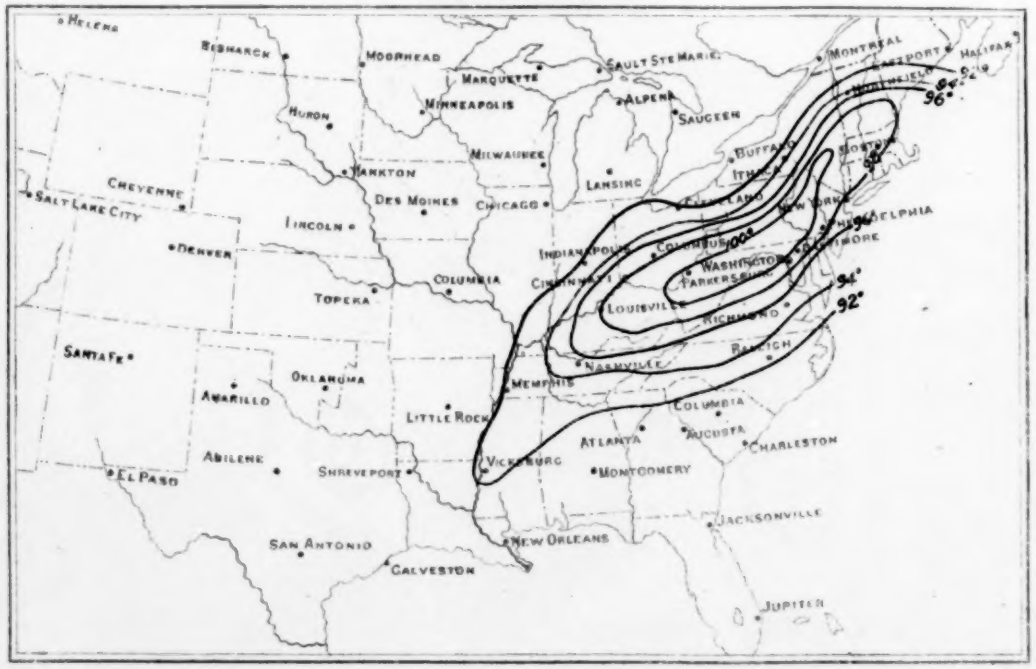
a. July 1, 1898, p. m.



b. July 2, 1898, p. m.



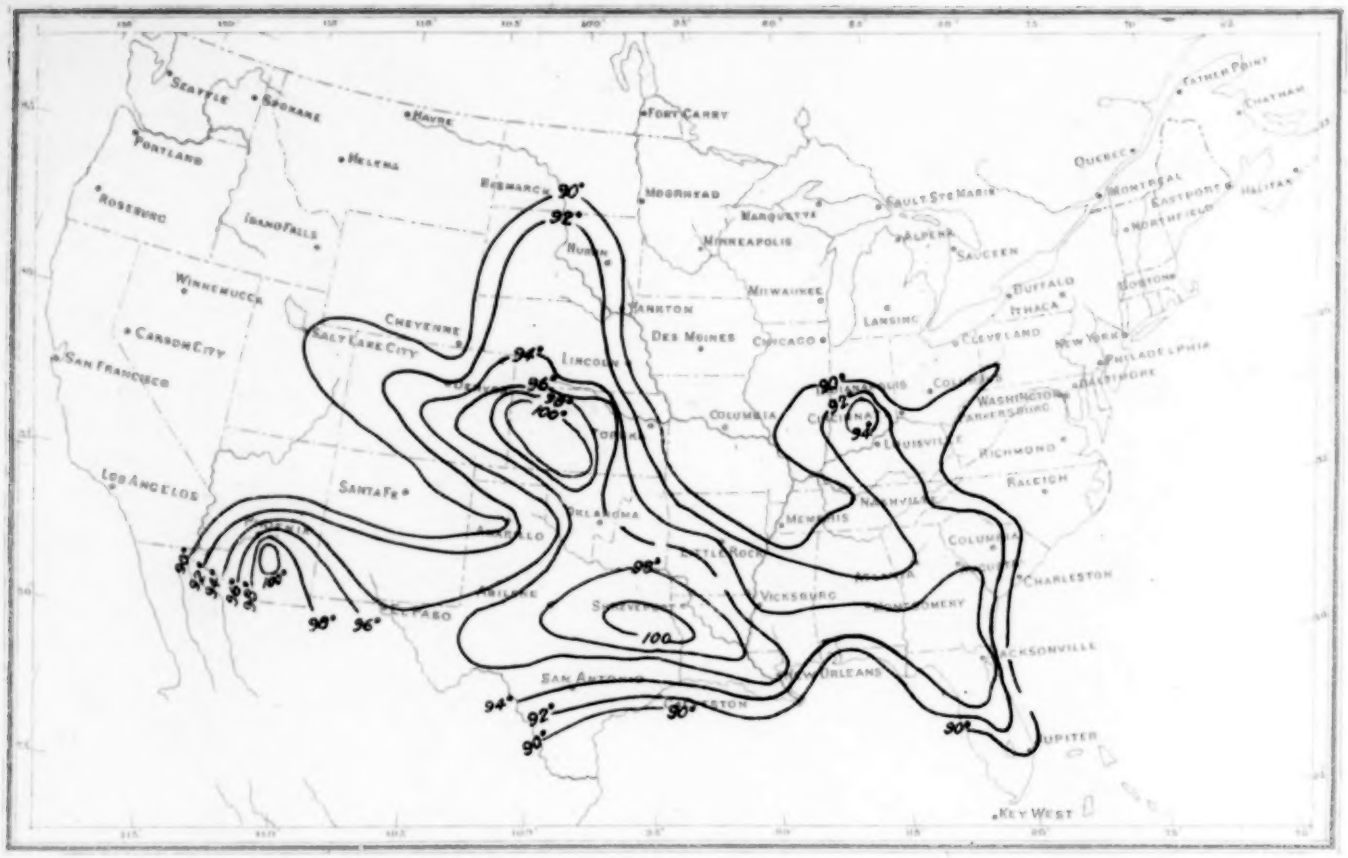
c. July 3, 1898, p. m.



d. July 4, 1898, p. m.

Chart IX. Maximum Temperatures.

a. July 22, 1898.



b. July 23, 1898.

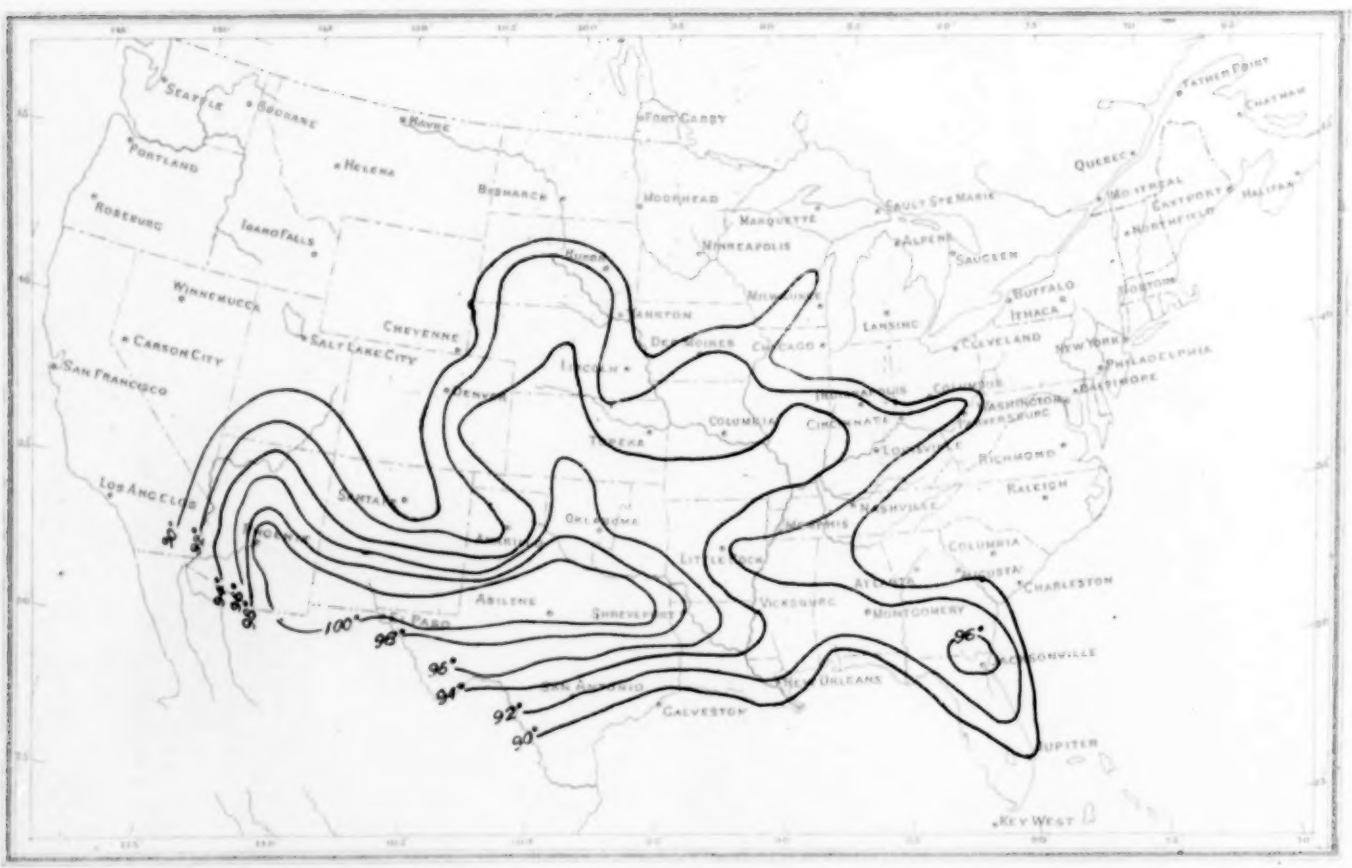
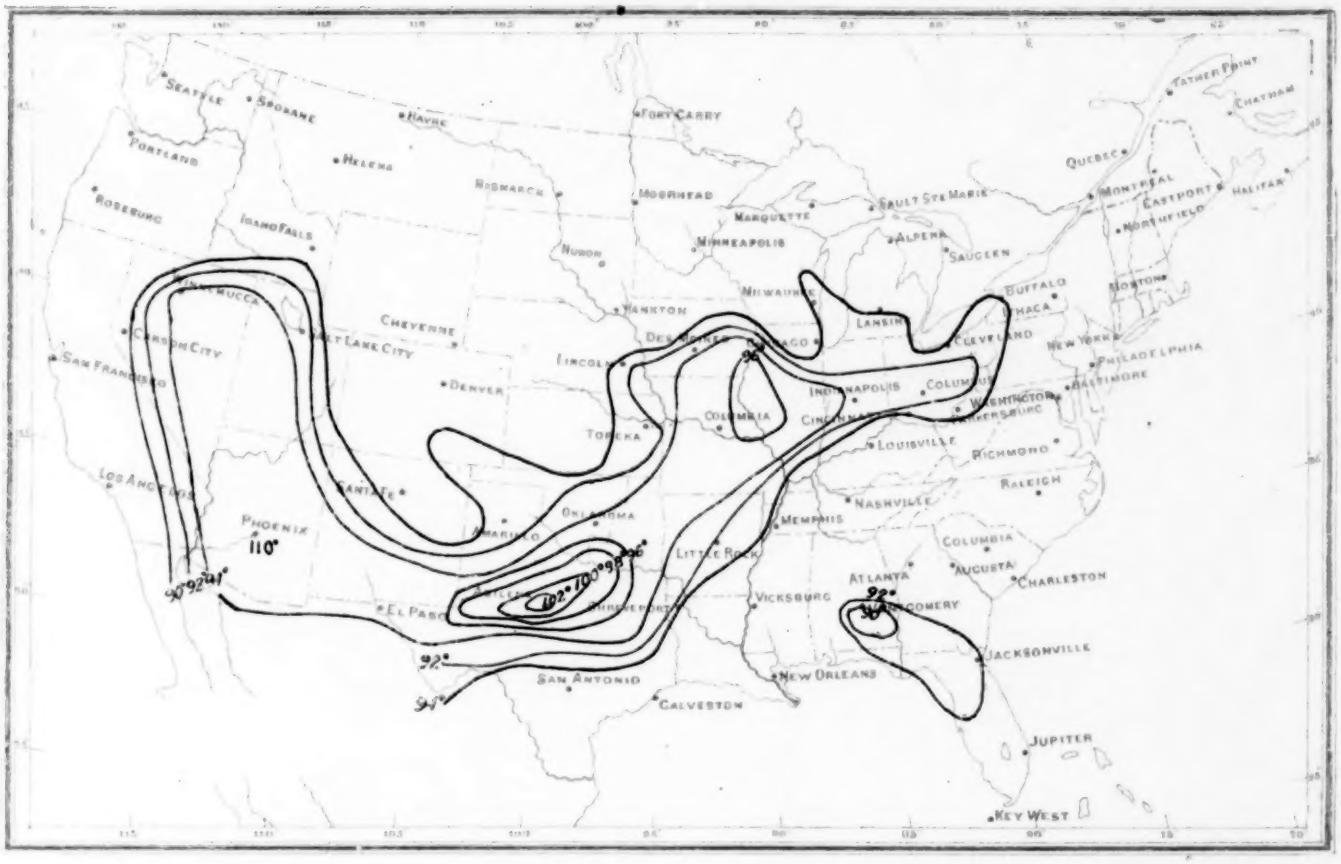


Chart X. Maximum Temperatures.

a. July 24, 1898.



b. July 25, 1898.

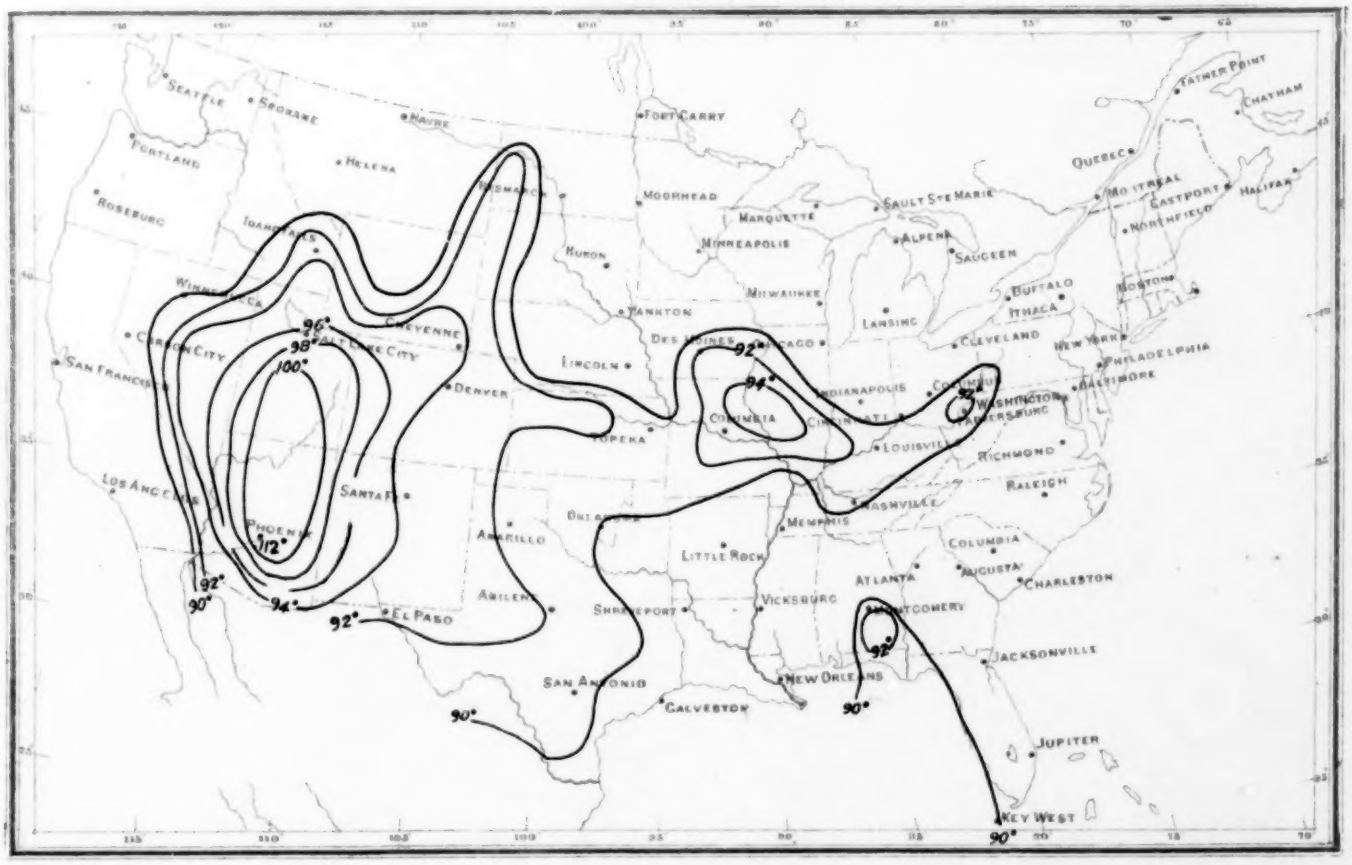
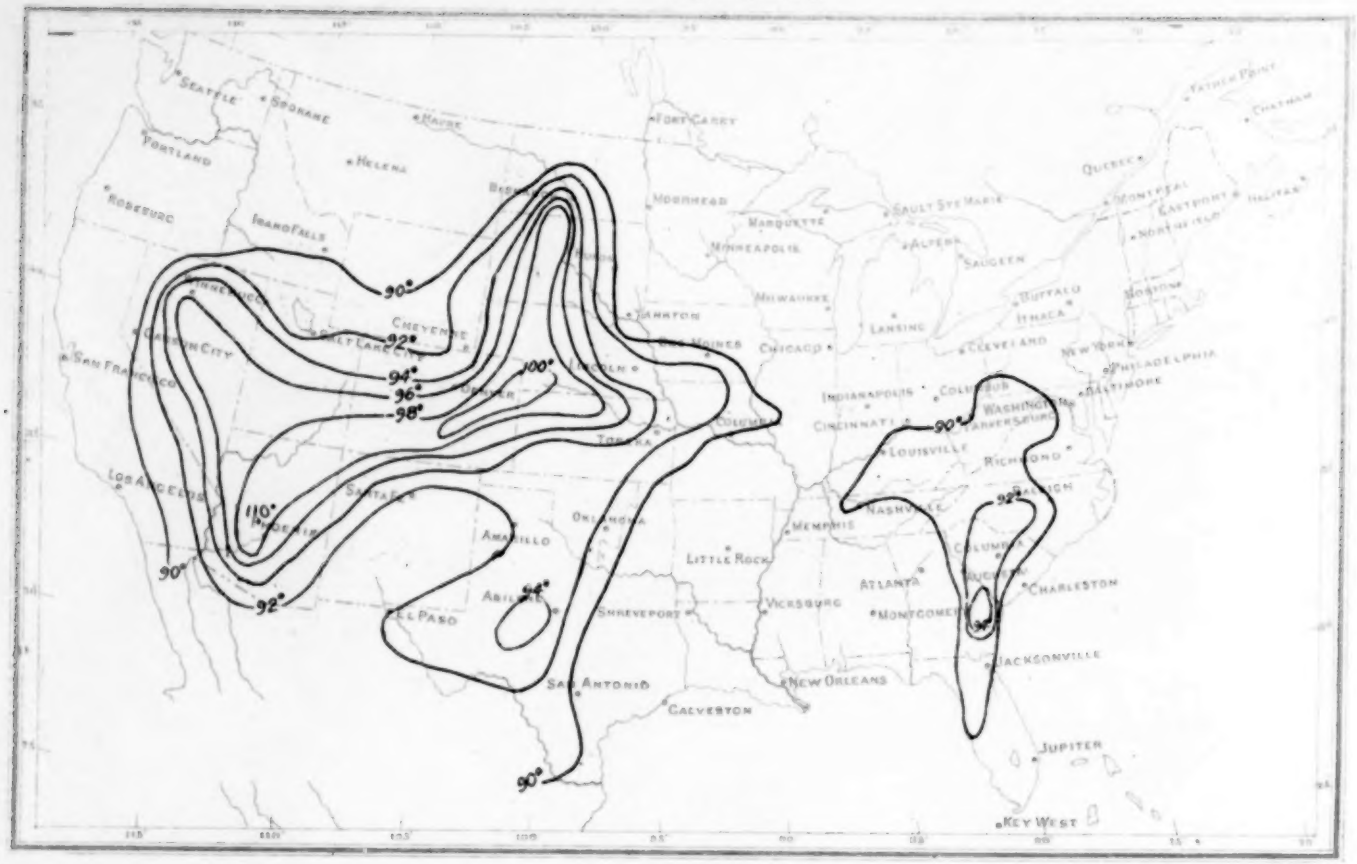


Chart XI. Maximum Temperatures.

a. July 26, 1898.



b. July 27, 1898.

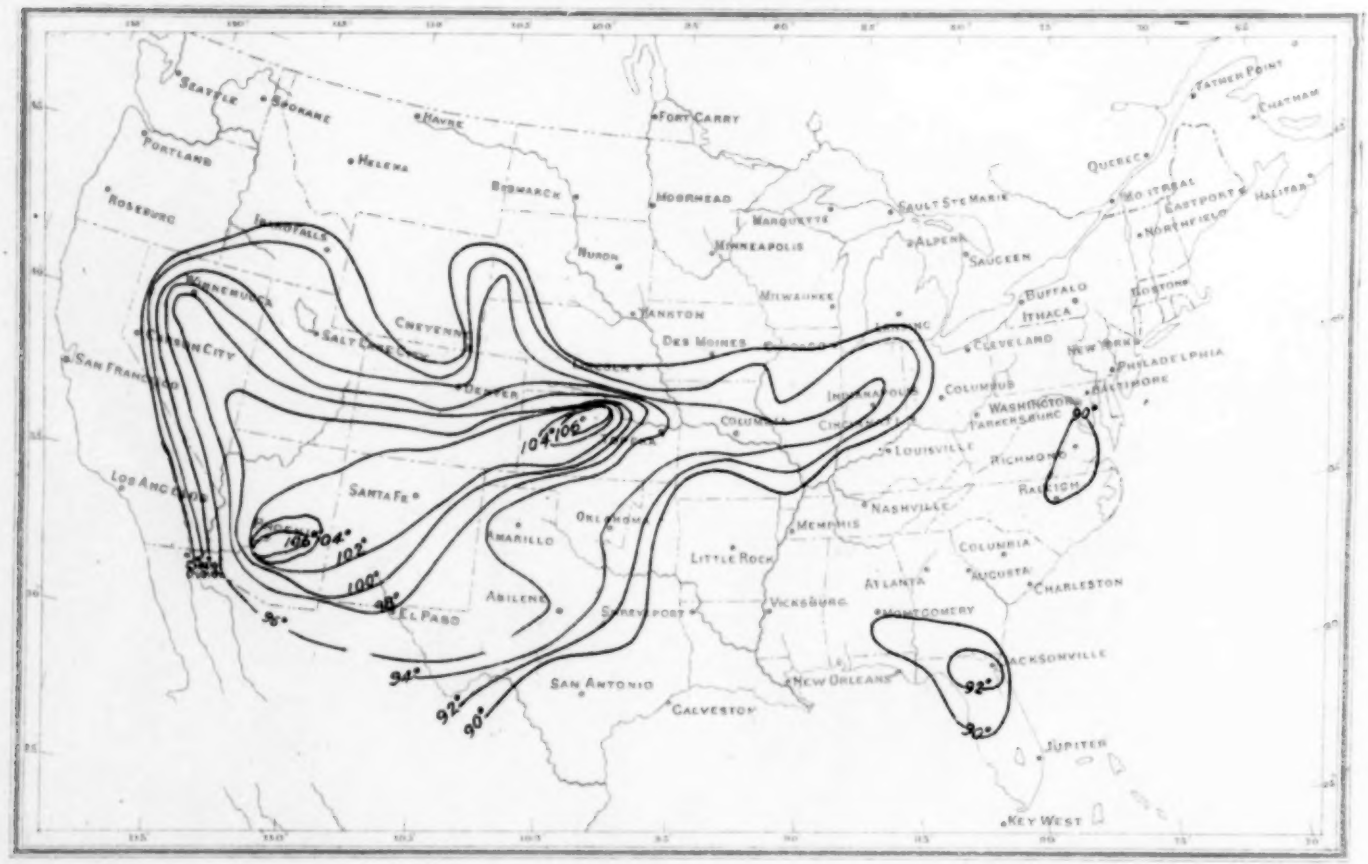
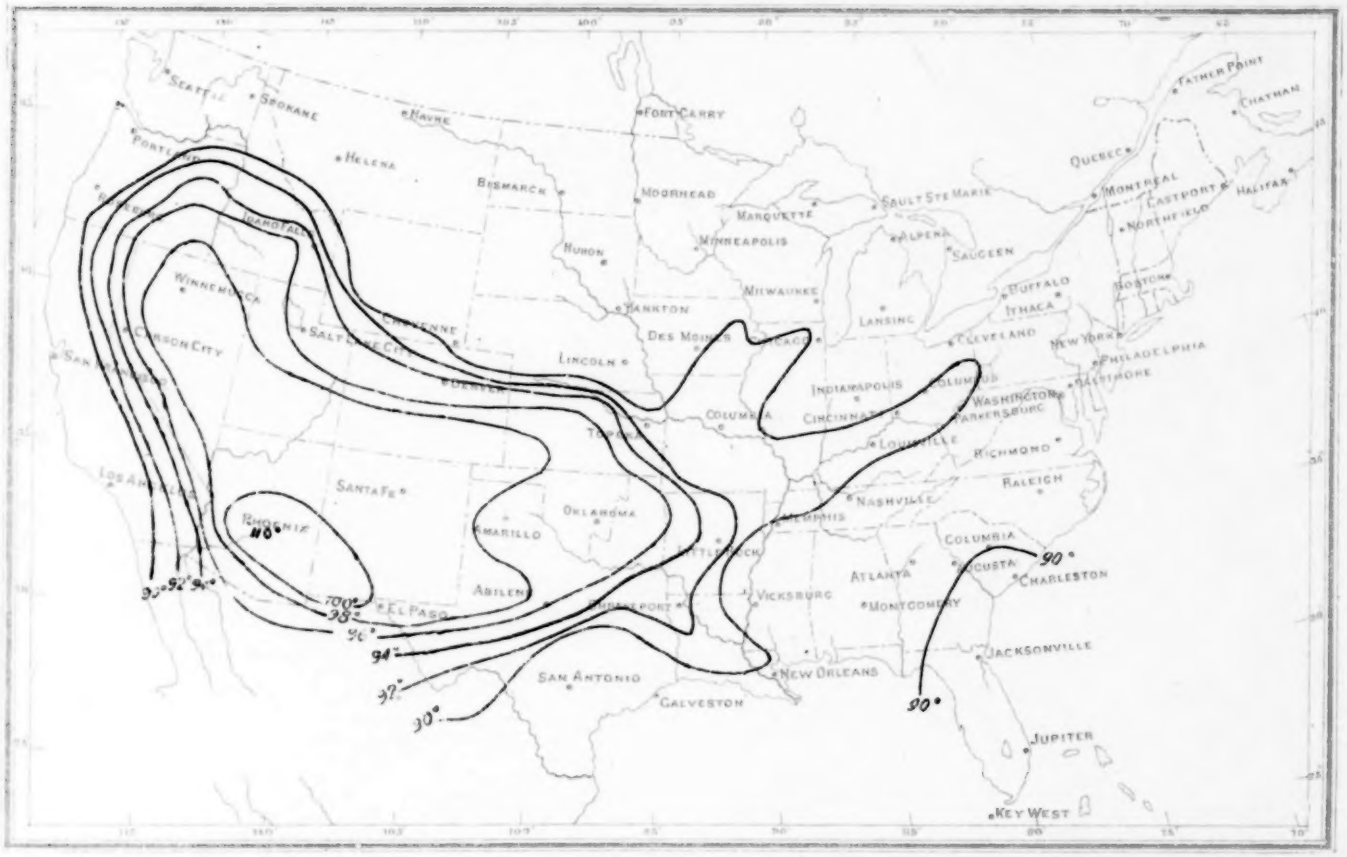
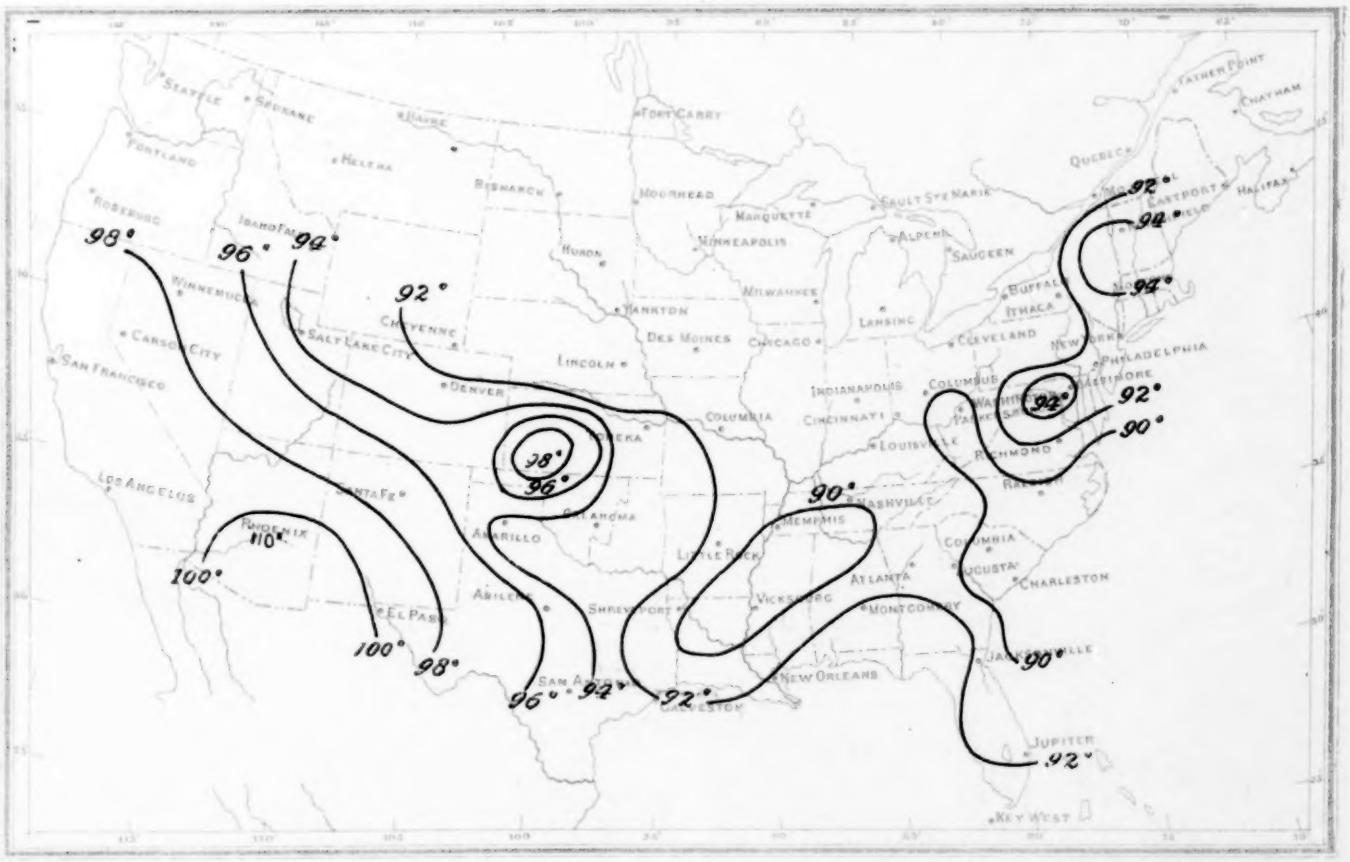


Chart XII. Maximum Temperatures.

a. July 28, 1898.



b. July 29, 1898.